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PEOPLE'S BANKING.

In a paper on "Scientific Agriculture in India" read before the Indian Section of the Royal Society of Arts in London on April 27th last, MR. MACKENNA, Agricultural Adviser to the Government of India, describing how the conclusions of science were being brought to bear on Indian agriculture, stated that in the union of the movement with that of Co-operative Societies lay the economic future of India. Therein also lies the economic future of Ceylon.

Co-operation has many forms, one of them being credit co-operation or people's banking intended for small working peasants, mechanics and traders. As has been well said—Credit for consumption is the road to poverty; credit for production the road to well-being. Without credit the labour of the producer is in vain. RAIFFEISEN was the first to conceive the idea of poor people combining to borrow moderate sums of money on their joint responsibility and lending it out among themselves at slightly higher interest. He started a loan bank on these lines in 1849, but it was five years before a second and eight years more before a third of its kind was founded. Now they exist in many countries and number many thousands. The principles are those upon which our Co-operative Credit Societies are founded—unlimited liability; membership confined to small areas where every one knows everyone; no loan except for an approved purpose and a loan to be used only for that purpose; no one but members permitted to borrow; repayments to be punctual; no security required; only men of good character eligible for membership; society's capital and credit increased by well-to-do neighbours making deposits. Anyone who takes the trouble to study

the matter will find that these fundamental principles are very wisely conceived and remove from the path of the peasant the barrier to advancement.

There are signs that the movement in Ceylon is making a new start and recovering from the set-back it received at the disturbances last year. MR. N. WICKREMARATNE'S paper read at the last meeting of the Ceylon Agricultural Society, and reproduced in last month's issue, describes what has been done by GATE-MUDALIYAR J. A. WIRASINGHE in his division. Last month MUDALIYAR SAMARAKKODY, another successful co-operator, founded a Society at Seeduwa under very favourable auspices. The MUDALIYAR A. E. RAJAPAKSE of Negombo promised the Seeduwa Society to deposit without interest Rs. 1,000 as soon as R1,000 had been subscribed, and to pay all charges, such as stationery, connected with the starting of the society. The Seeduwa members, who are fishermen, carpenters, small traders, potters and peasant cultivators, by subscribing a thousand rupees among themselves obtain another thousand from the Mudaliyar and a third thousand (if they want it) from Government.

The test of the progress of the co-operative movement is not so much the number of the societies formed, as the work done by them. Villagers sometimes form themselves into a society under the influence of a forceful personality and there stop. Most, however, are pursuing a career of healthy activity and using their capital over again as loans are repaid. The Minuwangoda, Kalapaluwawa, Adikari Pattu, Handapangoda, Magam Pattu and Kambukke Pattuwa Societies have loaned out from two and a half to three and a half times the amount of their paid-up capital; the Walapane five and a half times. The total amount of paid-up capital of the 55 societies registered is Rs. 26,100; the total amount of loans made Rs. 42,927; not an unsatisfactory record of work considering the short period that has elapsed since a start was made. There are indications that Co-operative Credit Societies are making progress in other directions. The Social Service League is promoting them among various working classes, such as rickshaw coolies, basket women, plumbago-store hands, railway workmen and domestic servants; while Missionary Societies are encouraging their parishioners to take up the movement.

R. N. L.

THE CEYLON AGRICULTURAL SOCIETY.

ADDRESS OF WELCOME TO SIR JOHN ANDERSON.

To HIS EXCELLENCY SIR JOHN ANDERSON, G.C.M.G., K.C.B., Ll.D., Governor and Commander-in-Chief in and over the Island of Ceylon, with the Dependencies thereof.

May it please Your Excellency,

In welcoming you as PRESIDENT of the BOARD OF AGRICULTURE we desire to express our earnest hope that the work of the Board may continue to prosper in the future under YOUR EXCELLENCY'S regime as it has in the past under that of your distinguished predecessors.

Signed on behalf of the Vice-Presidents and Members of the Board of Agriculture,

R. E. STUBBS,
Vice-President.

R. N. LYNE,
Organising Vice-President.

S. C. OBEYESEKERE,
Vice-President.

C. DRIEBERG,
Secretary.

P. ARUNACHALAM,
Vice-President.

HIS EXCELLENCY'S REPLY.

HIS EXCELLENCY, replying, said:—MR. STUBBS and Gentlemen, I am very glad indeed to be associated even in an honorary capacity in the work of this Society. I can conceive of no work of more importance to the future of the Island than that on which you are engaged. I know that it is work which requires dogged persistence and courage on your part because you have to deal with a class of people who by natural instinct are conservative; and perhaps poverty too in many cases renders them still more timid of adopting new measures and new ways. But your task, as I understand it, is mainly to supplement, to popularise and to inspire the numerous activities of the Department of Agriculture. There is thus as any one can see, and as I have done after only a brief experience of your island, very great scope for your work. But you have much encouragement for the future both in what you have already achieved and in the fact that what I saw at Peradeniya shows there is great hope that in the future your efforts will proceed with even more success than in the past. I am sure that you will find, when the teachers now undergoing instruction there and the scholars who are having the advantage of the school lectures and demonstrations take their place in the ranks of cultivators, far more gratifying results of your labours. At the same time you may be sure of an increasing demand for your inspiration and guidance, and I assure you that in forwarding your work you can count on my most hearty sympathy and support.

MR. JOHN HARWARD.

At the last meeting of the Ceylon Agricultural Society MR. E. B. DENHAM, the new Director of Education, paid a warm tribute to his predecessor, MR. JOHN HARWARD, one of the Vice-Presidents of the Society. MR. DENHAM, who was the first Secretary of the Society, said he had seen a good deal of MR. HARWARD'S interest and active co-operation in the work of the Society. The School Gardens' scheme owed a great deal to his persistence and the way in which he encouraged teachers to co-operate. His object was to bring

education in touch with agriculture and to encourage village teachers to start gardens in schools and to do everything to assist the movement. MR. HARWARD's desire to show that sympathetic interest and take the general all-round interest both in outdoor and indoor work of the Ceylonese children was what made him so popular. The Society regretted his illness and hoped that he would soon be restored to health and able to return to the island.

HIS EXCELLENCY THE GOVERNOR said he should like to associate himself with what had been said by MR. DENHAM with regard to MR. HARWARD. Though unhappily he had the opportunity of seeing very little of MR. HARWARD, no one who knew him could have failed to be struck by the fine spirit of enthusiasm and unselfish devotion to duty in the great work in which he was engaged. His Excellency added that he was sure members would echo the wishes expressed by MR. DENHAM that MR. HARWARD would be restored to health and return to the island; he hoped that members would recognise that, in so far as the work of the society was concerned, they had secured as MR. HARWARD's successor the gentleman who had first occupied the position of Secretary of the Society and who had, he believed, continued to be a member since its foundation, and he was sure that the work which was initiated and carried on by MR. HARWARD would be in capable and sympathetic hands.

We take the following from a letter to the TIMES OF CEYLON by "F. B."—By the retirement from the Public Service of MR. JOHN HARWARD the Island loses one of its best men. I know no official who can be regarded as his superior in knowledge, character, and devotion to duty . . . . Not only has MR. HARWARD maintained the best traditions of the Principalship of the leading Government educational establishment in Ceylon, but he has even gone beyond them, and added lustre to the Directorship of Public Instruction and Education. He has identified himself with the people of the country and their needs and aspirations—material, social and intellectual—in no less measure than had the revered DR. BARCROFT BOAKE, whose name is yet a household word throughout Ceylon, though he left us for Australia in 1871, and died there over 40 years ago. He has shown the dignity of the schoolmaster's office; and if he has failed to uplift the teacher to the extent he desired to, it was neither from lack of personal example, nor of efforts to induce the employer, whether official or unofficial, to offer wages commensurate to responsibility. What Principal, or what Director before him—and I have known them from JAMES STUART LAWRIE, the first Director—ever qualified in the vernaculars and even in the classical Oriental languages as he did? His inspections were neither formal nor money-making, but inspired by a true desire to benefit even obscure village schools and school gardens by first hand information. I write as a dweller myself away from main thoroughfares. He thus made work for himself despite the ever-increasing pressure on his time of a yearly expanding department . . . . He is a strong man in the best sense of the word, like the great apostle of the Gentiles, and was able to hold his own, without bluster or disloyalty, even against Governors—strong in initiative and in remonstrance, he had the true courage, like the gallant defender of Kut, which accepts inevitable defeat with submission. He was content to be misjudged by those who did not know the manner of his fight against odds. Of a clean record, as a man and an official, he has been an example both to his countrymen and to all classes of Ceylonese.

COCONUTS.

LEGUMINOUS CROPS FOR COCONUT GROVES.

Practically all coconut groves in Porto Rico are situated on sandy coastal plains. Due to the quality and fertility of this soil, many crops will flourish on it if cared for, and the cultivation among the palms of yuca, sweet potatoes, pigeon peas, and various other vegetables, has been a common practice for many years. These crops are cultivated for the seed or tubers which are used for food rather than for improving the soil. While the cultivation given these catch crops may be beneficial to the palms, the crops are often cared for at their expense. As coconut trees must be set at wide distances apart, if good returns are expected over a long term of years, and require a number of years before fruiting, the cultivation expense per tree is so high that it is often neglected and the grass allowed to occupy the lands. In these places a heavy sod is formed, which hinders air circulation or water filtration in the soil and exhausts the fertility in the surface soil where the small, feeding coconut roots are most numerous. Where the sandy land is exposed to the sun the vegetable matter is soon burned out of the surface soil and the changing temperature of the sand makes an undesirable consideration for the growth of the feeding roots. Until within the past few years the planting of cover crops in coconut groves was practically unknown in Porto Rico, but experiments with late-manuring, heavy-growing leguminous crops have shown that they are splendid crops for reducing the cost of cultivation, and insure excellent soil conditions for the development of the young palms. On the sandy soils devoted to coconuts cover crops should not be planted after the beginning of a severe drought, as the growth of the plants at this time is unsatisfactory. Spring and summer plantings of jack beans, pigeon peas, cowpeas, or velvet beans have been satisfactory, while fall and early winter plantings have resulted poorly in the case of pigeon peas and cowpeas, and the other crops have produced small plants with only a fair seed crop. In old groves, where there is a good stand of palms, the shade is too dense for the crops just mentioned to flourish, although they are preferable to the wild growth commonly found in these places. Planted in such a grove near Mayaguez in June, the jack bean made a more satisfactory growth than the Florida velvet bean, the clay cowpea, the pigeon pea, or the *Dolichos lablab*. The last-mentioned crop was the least satisfactory. Planted during the spring months in newly set groves, where there is a poor stand of palms and no shade to injure them, good crops of cowpeas, sword beans, jack beans, pigeon peas, and the different species of Stizolobiums previously discussed have been grown. Cowpeas planted under these conditions during April and May were very vigorous, a large percentage of the plants sending up vines which were 3 to 5 ft. in length aside from the otherwise heavy growth. A good crop of seed ripened in three months after seeding. On account of the edible seeds and green pods, the cowpea is usually the first crop to be accepted by the coconut plantation owners. Differing from the practice on heavy soils, the cowpea may be

planted during rainy seasons on sandy land. Here a good crop of both plants and seed will result, and the field may then be ploughed and another crop planted.

The pigeon pea makes a thrifty growth on coconut land, and it is valuable for killing out wild vegetation, and providing wind protection which is very desirable for young coconut palms.

Sword beans and jack beans planted in coconut groves in different parts of the Island in the month of April grew well, but the vegetable matter produced was much below that of several species of velvet beans, and the plants matured from two to three months earlier. Their growth was not sufficient to prevent the growth of wild vines and weeds, which are very persistent in many coconut groves.

Among the various crops tested, the Stizolobiums were the most satisfactory in young groves on account of their heavy growth and late development, which reduce the annual cultivation expense to a minimum. The species *S. velutinum*, *S. aterrimum* and *S. cinereum* make about equal development and make a heavier growth and have a longer season than the Florida velvet bean or the Lyon bean. Planted, April 7th, in a young grove where the soil is a rich sand, the Florida velvet bean matured its seed and the dying plants were overgrown with wild vines by July 20th. The Lyon bean made a heavier growth than the Florida velvet bean and matured one month later. The species *S. velutinum* matured nine months after planting. During this period of growth the only attention required was the cutting back, at intervals, of the vines near the palms. The cover crops excluded all wild vegetation during the growing period, and the blanket of dead vines and leaves, which was several inches in thickness, prevented weed growth for a month after the maturity of the vines, when they were ploughed under.

Great care must be taken that vines do not overgrow young plants, as the resulting injury is severe. Young palms overgrown for less than three weeks were observed to be lighter in colour when the vines were removed, and did not fully regain their colour in six months. The growth of the leaves was also greatly retarded.—PORTO RICO BULLETIN, No. 19.

[Jack bean = *Canavalia ensiformis;* Pigeon pea or dhall = *Cajanus indicus;* Cowpea = *Vigna sinensis*, a dwarf form of the native mé; Florida velvet bean = *Stizolobium deeringianum;* moché, = *Dolichos lablab;* Sword bean = *Canavalia gladiata;* Lyon bean = *Stizolobium niveum*.—ED. T. A.]

COPRA MAKING IN FIJI.

MR. C. H. KNOWLES, Superintendent of Agriculture, Fiji, in a departmental bulletin furnishes the following information regarding copra-making in that Colony:—

The kernels were dried in an iron-roofed room with copper-gauze sides for five days, with the result that 37 per cent. of the moisture was lost. Another five days completed the process of drying. The percentage of copra obtained from the kernel varied from 58·8 to 61·3, and the average oil content of the sample was 60 per cent.

It was found that 3,854 nuts went to make a ton of copra, that is, 965 to the candy (5 cwt.) which is pretty high; and that four nuts per tree per annum (with trees planted 30 by 30 ft.) will produce 1 cwt. of copra.

RUBBER.

GERMANY AND AFRICAN RUBBER.

An enquiry relative to the position of African rubber after the war was recently set on foot by the German Imperial Colonial Office, and information as to its prospects was sought from the German Union of Rubber Manufacturers. This body circulated a number of prearranged questions amongst its members, and the gist of the replies, as collected below, will not be without interest for our readers.

1. *What judgment are we to form as to the prospects of synthetic rubber?*

No one can give an absolutely assured judgment on the prospects of synthetic rubber. The production of synthetic rubber was achieved in the laboratory of MESSRS. FRIED, BAYER & CO., Elberfield, but it was costly, and until recently artificial rubber was not used. Now, however, it has been utilised to such an extent that MESSRS. FRANZ CLOUTH, of the Rhenish Rubber-goods Manufactory, have produced and continue to produce regularly a considerable quantity of synthetic rubber. They were able to employ it first of all chiefly in the making of hard rubber goods, but it has recently proved itself capable also of being used for soft rubber goods. Experience, however, is still lacking as to whether these goods are equal in durability to those made out of natural rubber. The use of synthetic rubber has this circumstance at the moment in its favour, that in consequence of the war, the price of rubber in Germany has risen to many times its amount before the war. On the world market the price of rubber has fallen greatly, as compared with what it was some years previously, owing to the great increase in the cultivation of rubber plants. This circumstance affects the prospects of synthetic rubber in an unfavourable way.

2. *Are savings in raw material likely to accrue through the greater employment of reclaimed rubber?*

Reclaimed rubber was already used in great quantities before the war. During the war the use of it has greatly increased in consequence of the deficiency in raw material. But it has been fully proved that only goods of inferior value and durability can be produced with reclaimed rubber, and it can best be employed for the making of goods in which the peculiar qualities of rubber do not play so large a part. Hence it is to be expected that after the war, with the rich and cheap offerings of raw rubber on the market, no saving will be effected through the greater utilisation of reclaimed rubber.

3. *Can rubber be driven out of part of its sphere of employment by substitutes?*

Many toys, ornaments, combs, surgical and technical instruments, which were formerly made of hard rubber, have lately been produced from celluloid, galalith, horn, resin mixtures, glass, etc. For jointing, instead of soft rubber, asbestos, fibres, leather, compressed paper, metal, etc., are used, and in some other direction soft rubber is displaced by lime-and-glycerine preparations. The possibility of a further development in these directions may be acknowledged, though as yet we have had very little evidence of it

4. *What market possibilities are likely to offer for the different kinds of African rubber?*

The selling possibilities of the African kinds of rubber depend chiefly on whether, with respect to quality and purity and price, they can bear comparison with other sorts, and specially with the plantation rubber from Ceylon, the Straits Settlements, Sumatra, Java, and other places, as well as with Brazilian kinds. Hitherto the comparisons have not been specially favourable to the African rubbers, and particularly as against the rubber systematically produced in plantations from Hevea, wild African rubbers have had a very difficult position. It is of importance that the collection of the rubber takes place in the neighbourhood of the coast, that the facilities of transport are good and cheap, and that wages are not too high, if the African rubber is to have a chance on the market.

One of our committee members writes: I am of the opinion that the future belongs to the plantation kinds of rubber. The modern plantations bring the rubber washed and dried on to the market in an essentially more uniform quality as compared with wild rubber. Hence, and because with the greater age of the rubber trees the value of the rubber becomes higher, there occurs a continual advance in the values of these sorts. Of the African sorts of rubber my factory has chiefly used South Cameron, and had the best results with that kind. On the other hand, Manihot rubber was with advantage displaced by Hevea plantation sorts. The Congo sorts are in themselves good, yet in recent years parcels uniform in quality have fallen off greatly as compared with earlier years, as the result of hurried and careless tapping, and the prices demanded were too high relatively to Hevea plantation sorts.

Another member of the committee writes: The possibility of a market for African sorts of rubber will become continually more doubtful through the constantly increasing production of plantation rubber; only a considerable lowering of the price of African sorts will make a market for them possible within the immediate future. If we suppose as probable the average price for the best qualities of plantation rubber to be about 4·50 marks per kilogramme, then an African rubber must, in consideration of its poorer quality as well as its important loss of weight in washing and drying in the raw condition, not exceed a price of about three marks to 3·50 the kilogramme. Should the price of plantation rubber range lower than 4·50 marks the kilogramme, which is not at all impossible, then, of course, the price of African rubber must accordingly be reduced.

A third member writes: According to past experience it is hardly to be expected that rubber plantations in Africa will be capable of competition in the condition of prices which will be established at the conclusion of peace, for in my opinion the obtaining of rubber from African plantations will only be profitable if other products are also produced on the estates, in order to spread the general expenses of the plantations over different products. For rubber alone, a plantation will absolutely fail to pay itself.

Undoubtedly both the German Colonial Office and German rubber manufacturers and handlers must have plenty of leisure just now for enquiries such as the above. But have they any serious purport? Was the chief object to find out how far if at all German rubber supplies could be made independent of British plantation rubbers? Perhaps the most important point is the indication given that the German Colonial Office hopes to secure, at the conclusion of peace, a large rubber-producing area in Africa. Does Germany hope to find herself heir to Belgium in the Congo Free State?

—INDIA RUBBER JOURNAL.

RICE.

THE DIFFERENCES OF HUMIDITY IN RIPE PADDY.

VITTORIO MARAGHINI.

One of the requirements most desired in a paddy drier is the production of uniform product. To ensure this result it is necessary to realise that different lots of grain contain different degrees of humidity, and since the drier only removes a portion of the moisture differences will exist in the final product. It is already known on *a priori* grounds that the moisture content of paddy grains varies in the same field in the same season since the grains become drier with maturity, and maturation varies at different places in the same field and even in different positions on the same ear.

These differences were determined by the writer in rice crop considered for all practical purpose as homogeneous. The field selected was at Rozzano near Milan and had an area of 22 acres. The season 1915 was normal and the harvest very clean. Determinations of the humidity at 110°C. gave results as follows:—

	Percentage humidity by weight relative to green paddy.
Samples from the centre of the field:	
Grains of the entire ears	21·9
,, ,, ,, tips of the ear	20·6
,, ,, ,, base of the ear	22·6
Samples from a place near the irrigation channel:	
Grain of the entire ear	30·9
,, ,, ,, tips of the ear	27·4
,, ,, ,, base of the ear	33·5
Maximum difference of humidity between the different lots of paddy in the field, expressed as percentages of average humidity	47·7
Maximum difference of humidity between grains of the same ear, expressed as percentage of average humidity	
for ears from the centre of the field	9·3
for ears from near the irrigation inlet	20·3

The humidity is therefore less in the case of ears collected from centre of the field than for those collected near the irrigation inlet. It is also less for grains at the summit of the ear than for those at the base, this difference being about 10 per cent. of the average humidity. Obviously the differences of humidity of the crop submitted to drying are far from negligible, and are certainly greater for a harvest less favoured by season and situation than the one used in these investigations.—BULL. INT. INST. OF AGRIC.

FRUIT.

BUDDING THE MANGO.

According to MR. WESTER of the Philippine Agricultural Department, mango trees should be budded when about a metre (3 feet 3 inches) high. The budding knife should be properly sharpened and bud-wood taken from an old tree which is known to be productive and to bear good fruit. His directions are: "Select bud-wood that is well matured from the 1st, 2nd and 3rd flushes from the end of the branch. This bud-wood is always green and smooth."

"About three weeks in advance of the date when the budding is to be performed, cut off the leaf blades of the bud-wood selected. This causes the leaf stalks to drop. When scars left after the petioles have fallen are well healed, the bud-wood is in condition for budding.

The buds should be cut about 4 centimeters long (about 1 $\frac{3}{5}$ in.), with an ample wood shield, and inserted in the stock at a point where the bark is green and smooth, like the bud-wood, not where it is rough and brownish. Use waxed tape and cover the entire bud. When in the course of two or three weeks a good union has formed, unwind the wrapping so as to expose the leaf bud from which the growth is to issue, and cut off the top of the stock 10 to 15 centimeters above the bud.

Every ten days after unwrapping the buds, go through the nursery and carefully rub off all sprouts from the stock in order to force the buds to grow. When the graft has made a growth of about 30 centimetres, cut off the stock immediately above the point of insertion of the bud."

THE DYING OF CITRUS TREES.

MR. ALBERT BENSON discusses this in the QUEENSLAND AGRICULTURAL JOURNAL of May last, and as the dying-out of oranges in Ceylon appears to present the same characteristics his observations are of interest to local growers.

It is considered probable that the age to which citrus trees live, especially under more or less tropical conditions, depends largely on the soil in which they are planted and the conditions under which they grow. The more even and regular these conditions the longer the tree is likely to live Extreme changes brought about by drought and rainfall are unfavourable to healthy and continuous growth. To remedy this, judicious irrigation is recommended whenever the trees show signs that they need moisture. Where water is not available thorough cultivation should be practised.

Irregularity of growth is thought to be one of the primary causes of trees dying, inasmuch as lowered vitality renders them unable to resist fungus

disease which is invariably associated with the death of the trees. Another point to be attended to is regular and moderate manuring (so as to promote regular growth instead of over-manuring at long intervals).

Insufficient drainage is another factor which exercises an unfavourable influence.

As regards the diseases associated with the dying-out of the trees (probably due to *Phoma omnivora* and other fungi) the following treatment is advised:—

(1) Systematic pruning away of all dead branches, which should be burnt; (2) Spraying the trees with lime-sulphur wash as a preventative; (3) freely using the knife when gumming appears, so as to cut out all diseased tissue, and sterilising with carbolic acid (one part of crude acid to one of water), or painting the wound with strong solutions of lime sulphur; (4) application of from 2 to 4 lb. of lime, or from ½ lb. to one lb. of sulphate of iron to the roots; (5) sterilising all pruning tools by dipping in a 5 per cent. solution of formalin mixture (1 oz. formalin to 1 pint of water). (6) It is also advisable to treat the roots, scraping away the soil round and applying air-slaked lime or finely powdered sulphate of iron. A handful of common salt in 4 gallons of water has also been found to do good.

REMEDIES FOR TWO COMMON PESTS.

Complaint comes to the Division of Entomology of young plants and vegetables being damaged or killed by worms which are found curled up in the soil about the plants. These are cut-worms, the larvæ of owlet moths. Searching for the worms around the plants and killing them will naturally check their ravages. The following poison baits placed about the plants in small quantities will attract the cutworms and will readily kill them. Use the following ingredients:—

Paris green, ½ pound | Molasses, ¼ gallon

Bran, 10 pounds.

Mix the Paris green and bran dry, seeing that they are thoroughly mixed Add the molasses and just enough water to moisten the mass. Place the mixture about the plants in small quantities, from a teaspoonful to a table-spoonful. Care must be taken to keep domestic animals, chickens or small children away from the poison.

ROSE MILDEW.

Many tea roses now show a white powdery or mealy substance on the young foliage. This is the powdery mildew, a very common fungus of various plants. When first noticed it can be checked by dusting the plants with dry powdered or sublime sulphur. In very bad cases where the fungus has been allowed to spread for some time, the following remedy will give good results:—

Dissolve 1 oz. of copper sulphate (bluestone) in 1 pint of hot water. Dissolve 2 oz. of carbonate of soda (sal soda) in 1 pint of hot water. Mix the two solutions and let stand for a few hours; then add 1½ liquid ounces of ammonia and add enough water to make 1½ gallons of spray mixture with which to spray the plants thoroughly. Repeat the spraying again in two or three days if the plants are badly infested.—HAWAIIAN FORESTER AND AGRICULTURIST.

INDIAN COTTON.

PROFESSOR J. A. TODD, Special Lecturer on Economics at the Punjab University, and Author of THE WORLD'S COTTON CROPS, writes as follows:—

It would be not only possible, but very profitable for India, to increase the quantity and improve the quality of her cotton crop. It has, however, been objected that the effect might be disastrous, by causing a slump in the price of cotton and leaving India with an unsaleable crop. It is pointed out that the price of cotton has been very unreliable in the past, and further, that Indian cotton is of a peculiar character and quality for which the demand is comparatively circumscribed. There is sufficient truth in these suggestions to make it worth while to answer them in some detail.

It is true that the price of cotton has fluctuated very severely in recent years; but the tendency has always been upwards, and even in 1914, with all the weight of a record American crop and the war to depress it, the price did not after all touch anything but *comparatively* low figures, not nearly so low as what were almost normal figures twenty years ago. But the essential fact of the position was only made more clear by the war, namely, that whenever prices have gone low they have always recovered very quickly, and very soon have gone higher than ever. The reason for this is that the whole cotton-growing world is now rising out of the very bad economic status which it had so long suffered from; that the growers, especially in America, are now developing a power of resistance to low prices, a strength of reserve which enables them simply to hold their cotton when prices are below cost of production, and which is therefore making it more and more unlikely for prices to remain long at unremunerative levels. This power of the American planter to hold the crop for his cost of production is the salvation of the Indian cotton-grower, for the price which just pays the American planter, means a very remunerative price for the Indian grower, and it must almost necessarily always remain so. The cost of production in America is bound to remain much higher than in India, with its almost inexhaustible labour supply, for even if America did succeed in reducing the labour cost of her crop by labour-saving appliances, such as a mechanical cotton picker, it would be perfectly open to India to adopt these appliances too, if she found they were actually cheaper than her cheap labour. It must, of course, be kept in view that the labour cost in India will rise too; it is indeed already rising considerably, and a very good thing it is for India in many ways that it should be so; but there is a tremendous margin between the dollar or dollar and a half per day of the American negro and the present wage of the Indian day labourer. There is, therefore, little prospect of the American producer ever being able to reduce his price to such a level as to make cotton unprofitable for his Indian competitor.

But, it is said, if the Indian crop is materially increased, the total world's supply may be increased in excess of the demand, and a permanent return to low prices ensue. In the first place it is not suggested that India should double her crop in a year or two, or go on doubling it every few years till the world is flooded with cotton. The most that she can possibly do is to add, say, a million bales to her total every year or two, and at that rate there is simply not the slightest chance of permanent or serious over-production. The American crop has been increasing almost as fast as that for some years,

and still the supply cannot keep pace with the possibilities of demand. Ten years ago a ten million bale American crop was looked upon as quite an average. Now anything less than fifteen million bales is regarded as distinctly on the short side. The fact of the matter is that demand is increasing faster than supply, and an increased supply of a steady million bales more per annum would be taken up without the slightest difficulty at good prices. And if, as in past experience, we do have an occasional bad year, at least India is much better able to bear it than America.

Again it is argued that the peculiar character of Indian staple confines its market to a very limited area of demand, and that an excess of Indian cotton might cause an over supply of that particular kind of cotton, though the general cotton position was quite otherwise. There is again some truth in this, and there is no doubt that Indian cotton should have been very badly hit by the war, for the Continental countries which used most of it were Germany, Austria, Italy, and especially Belgium. It was very largely used there in the waste trade, *i.e.*, for mixing with waste cotton from the mills which use finer cotton, and was put into all kinds of cheap fabrics such as cotton blankets, imitation tweeds, hosiery, yarns, etc. But not one of these countries used as much as 200,000 bales in 1912-13, the last year for which the International Cotton Federation statistics are available, while India herself used over two million bales, and Japan nearly half as much. In other words, the great users of Indian cotton are in the East, not in the West, and these are just the countries which so far from suffering from the war have actually been gaining by it through the opportunity which it has afforded them of picking up their opponents' trade. Japan has simply saved the situation for the Indian cotton-grower since the war, and is likely to continue doing so, for Japan is the keenest buyer of cotton in the world, in this way that her geographical position in relation to America and India makes it possible for her to buy always in the cheapest market. Thus when American cotton is cheap, Japan uses large quantities of American; and she will do so still more effectively now that the Panama Canal is (occasionally) open. But when American cotton is dear, Japan quietly shifts over to Indian or Chinese, which is very good cotton and a very large crop, if reports be even moderately true. Further, Japan has proved recently a very willing buyer of good Indian cotton, particularly of the improved Punjab American varieties, for which she has materially helped to create a satisfactory market.

This again suggests the answer to another question that is frequently heard, whether there is any surety in the demand for improved staple cottons grown in India. Lancashire, it is said, will not use them; India herself cannot, and Japan will only take them at a price below their real value. All these statements may be disputed. It is true that Lancashire has been seriously prejudiced by past experience against Indian cotton on account of its unsatisfactory condition, and rightly so. But as fast as India learns how to handle her crop properly and export it in good condition, so will Lancashire learn to use it and to value it properly. After all there is no better market in the world for cotton, especially good cotton, than Lancashire: and she is always ready to pay the highest price for it. Already she has been using a considerable quantity of Cambodia cotton from Madras, and would have been very pleased to take more if the quality could have been maintained, as unfortunately it has not. Again it is not true that India cannot use higher grade cotton than the ordinary Indian short staple. She is already using the bulk

of the finest cotton grown in the Surat districts and in Southern India, and quite recently the Nagpur mills have been heavy buyers of Punjab American. The best of the Indian mill-owners are quite alive to the fact that the only way to meet Japanese competition is to keep on steadily improving the quality of the goods produced by the Indian mill. India can easily beat Japan on her own ground if she makes up her mind to adopt improved methods. It pays the Indian mills to use good cotton grown in India rather than import American cotton, as they have always done to a limited extent in the past.

From the side of demand therefore there need be no doubt of the largest and best crop India can grow finding a good market. The world will want all the cotton it can get for the next ten years at least, and India has her opportunity now to take her share in supplying that demand. For there can be no practical doubt that after the war the demand for cotton goods will be very active for a time. It is said that Dutch firms in Manchester are at present buying large stocks of cotton goods and storing them to be ready to rush them into Germany immediately peace is declared. It will take the German mills some time to recover their pace after the war, and in the meantime the world's stocks of cotton goods must be very low. But the world must be clothed again after the war, and it will take time—and cotton—to do it.—C. AND M. GAZETTE.

PALMYRAH PALMS—A NEW SOURCE OF REFINED SUGAR.

The announcement that the Ceylon Sugar Refineries, Ltd., are likely to place sugar on the market next month, is a notable one, and if the Company's produce successfully enters into competition with cane and beet sugar in the World's Market its promoters will be deserving of sincere congratulations.

The accompanying illustration shows a typical grove of Palmyrahs (*Borassus flabilifer*), the source of the sap which the Company is dealing with. It will be observed that the palms are not planted with any attention to order or proper spacing, and yet they thrive with extraordinary vigour in the dry North of the Island and are free from pests and diseases.

Hitherto the palmyrah palm has supplied the bulk of the inhabitants of the Jaffna Peninsula with practically all their requirements and the leasing of the trees to the new Sugar Company will make no little difference in their domestic economy, while the free circulation of money among the working classes as the result of the Company's operations, particularly in the employment of a large local labour force, should improve the conditions of rural life in the North of the Island.

Photo by S. K. Lawton.

"PALMYRAH PALMS: A NEW SOURCE OF REFINED SUGAR."

SOILS AND MANURES.

SOIL DENUDATION.

There are few questions connected with the agriculture of the Island of such paramount importance as that of soil erosion and denudation, and those who have observed the effect (so much in evidence recently) of the torrential monsoon rains in carrying away the best part of our cultivated soils in the hill country must have realised the enormous loss of fertilising matter which these lands sustain at each recurring wet spell.

The subject has lately occupied the attention of the Board of Agriculture in India, in whose opinion the damage done to the soil by surface washing is so enormous that it cannot be made good by any system of manuring. Though this question affects the tea planter more than any one else, still the evil and its remedy concern all cultivators of steep land, whatever the crops they are growing.

The Indian Board of Agriculture are so sensible to the danger which menaces our cultivated lands in the tropics and threatens to impoverish them to such an extent as to make their economic development a doubtful enterprise, that they recommended (1) that the Government be requested to bring to the notice of planters the urgency of adopting effective measures to prevent soil erosion on existing areas and on new areas when opened, and (2) that local Governments should safeguard against this danger when fixing the conditions on which new lands are given out.

As this subject is one which concerns us so intimately (and the case of Ceylon is specially cited in the notes which follow) no apology is needed for reproducing the substance of a memorandum drawn up by DR. HOPE, Scientific Officer to the Indian Tea Association, and published in a recent issue of the AGRICULTURAL JOURNAL OF INDIA.

At the end of 1913 DR. HOPE spent some time in Java and Sumatra to study the measures there adopted to prevent wash, and makes the following observations and recommendations.

The whole of the tea districts of Java is sloping land, and it is the invariable custom to plant tea fairly closely on contour lines as distinguished from square or triangular arrangement, the result being that there are no spaces between the bushes in straight lines of any length down slopes such as can be seen on estates in Ceylon and North-East India. Contour planting is undoubtedly the better method whenever there is a possibility of serious erosion.

Other means are adopted according to the nature of the land, and these consist in terracing, where the land is steeply sloping, and in less steepland arranging a system of contour drains, contour hedges of suitable leguminous plants, and series of catch-trenches in contour alignment.

Opinions differ as to value of terraces, a fact which seems to indicate that there may be some factor as yet not fully understood which accounts for terraces being of use in some places while in others their value appears to be doubtful. On Ceylon tea estates says DR. HOPE terraces are rarely seen in spite of the fact that much of the tea land is more steeply sloping than on

most estates in Java; and he expresses surprise that the terracing which is so picturesque a feature of the journey from Colombo to Kandy has not been copied. He considers the omission an error in judgment though a still greater mistake was to have adopted linear instead of contour planting on sloping ground.

Opinions also differ as to whether terraces should be made before the tea is planted or afterwards. The argument in favour of making the terraces before planting the tea is that the work can then be done carefully and completely without any disturbing factors, and when the tea is eventually planted it merely remains to keep the terraces in order. Those who are in favour of making the terraces after planting out the tea base their argument on the fact that in such cases the tea is planted in surface and not in sub-soil, and that if the weeds, when they are gathered, are regularly placed between the rows of tea, planted in contour lines, terraces form of themselves and are in all respects as efficient as those made at greater cost before planting of the tea. It is possible, however, to make terraces before the tea is planted out in such a way that the seedling plants are planted along the lines of trenches which have been filled in entirely with surface soil, and it is more satisfactory from several points of view to make the terraces before the land is planted.

The upkeep of terraces is a matter of great importance. In Java many different plants are used to protect the edges and faces of terraces and are either planted there directly or, if of naturally occurring species, are encouraged to grow in preference to other plants by a process of selective weeding of the terrace faces. Species of *Hydrocotyle*, *Viola*, *Desmodium*, etc., are commonly seen growing in this way.

On fairly broad terraces it is often the custom to dig short trenches at intervals along the inner edge of each terrace and these serve to catch the wash which comes from the terrace above. These catch-trenches are cleaned out when the terraces are weeded. and the earth which has collected in them is thrown up on to the terrace above.

The system is an excellent one under Java conditions where weeding and forking, instead of hoeing. is the method of cultivation.

A similar system of catch-trenches is employed largely in cases where the land is not steep enough to terrace. The method then generally adopted is one of alternate contour lines of catch trenches and of green crops, sometimes with one and sometimes with two lines of tea between them. In such cases the positions of the catch-trenches which are usually about 12 feet long by 1 foot broad by 1½ feet deep, alternate with 12 feet intervals along the contours, and are arranged in echelon with those next above or below along different trenched contours, so that if any earth is carried beyond one line of catch-trenches and past the intermediate tea bushes and green crop hedge, it will eventually be caught in the next catch-trench below. When these catch-trenches are cleaned out, which is usually done at the time of weeding, the earth is thrown up the slope.

Leguminous plants such as *Leucæna glauca*, *Clitoria cajanifolia*, *Tephrosia purpurea*, etc., are the plants most commonly used for the hedges which alternate with the catch-trenches.

Combined with this is a careful system of drainage.

The main drain system leads directly down the slopes, and it is considered most important to remove as far as possible the excess water which cannot sink into the ground sufficiently rapidly in case of heavy showers.

The soils of Java are very porous and when slight showers fall the rain sinks rapidly into the ground, but the soil is also very rapidly washed down by water flowing over the surface of the ground, if all the rain water is not immediately removed when heavy rain falls. This is at once the advantage and the danger of the soil of Java.

To prevent this loss by wash, it is considered of primary importance to have an escapement for excess water, and the main drains straight down the slopes serve this purpose best, for they ensure the rapid removal of water at places which are chosen for the purpose, and not at places where the rush of water may do damage.

The best situations for some of these drains are the places where there are natural gullies down the concave folds of the hillsides. Where these gullies are pronounced in character one usually finds either rocky ravines, or water-logged patches filled with deep rich soil which has been carried there by wash before the opening up of the land. The stone ravines can be used as drains without much being done to them, except straightening and cleaning out to facilitate the rapid removal of water. Gullies which are filled with deep earth, when drained, add to the area that can be planted. The sides of these drains are protected by growing grass on them and the rush of water down them is stopped by a series of low barriers of stone, bamboos, etc. A certain number of main drains have also to be made at intermediate positions between the gullies, and the distance between two such drains is usually not more than 100-200 yards.

The collection of the water into the main drains is effected by means of contour drains which are usually made with a very slight gradient, the object being merely to catch the water and remove it into the main drains. These contour drains are laid out very carefully on Dutch estates in Java, and are flanked on the upper and lower sides by banks on which suitable leguminous plants are grown. Grass is often grown on the sides of the drains themselves which are cleaned out periodically, to avoid the danger of water breaking through and causing the escapement of water down hill at a point for which preparation for its control had not been made.

Modification of one or other of these methods is adopted in Java and on some of the new tea estates which are being started in Sumatra.

There is some difference of opinion in Java as to the extent to which cultivation is a factor in aggravating loss of surface soil by wash. Some claim that if soil be cultivated during wet weather the rain, instead of washing the soil with it down the slopes, sinks into the ground and thus prevents wash. Others believe that if the soil is undisturbed, and particularly if it be protected with a slight covering of jungle, wash will be inappreciable. Very much depends on the nature of the soil and this is a subject which should be studied with a view to—and it would be worth while—determining in districts where loss of surface soil by wash is known to be great, the effect of cultivation in aggravating or reducing the amount of wash and to correlate this information with data bearing on the mechanical composition and physical properties of the soil.

Another point which has so far been left out of discussion is extent of "dry wash"—that is, the movement of particles of soil down hill in dry weather as the effect of wind. In Java, this dry-wash occurs chiefly at medium elevations where the soil is loamy in character but is of sufficiently good tilth to pulverize on the surface in dry weather. The compact soil immediately below

the loose layer on the surface affords a comparatively smooth plane down which detached particles of surface soil are blown by wind. These particles collect behind tea bushes and stones and on the flat faces of terraces, and are washed down in the form of mud by the first heavy shower of rain.

The extent of loss of soil which goes on steadily in this way in dry weather is undoubtedly very great in some districts of Java, and it would be interesting to determine whether a similar phenomenon takes place to any great extent in India and in what localities it occurs particularly.

Speaking of tea planting only DR. HOPE remarks that the methods emplóyed in Java appeal to him as being unquestionably the best that can be done to prevent loss of surface soil, and although it is a matter of great expense and trouble, yet, where tropical agriculture is becoming yearly more intensive and new land cannot be obtained to replace the older parts of estates, all that can be done to prevent loss of surface soil on existing estates is of very great commercial value.

The present measures adopted for the prevention of wash in the tea districts of Ceylon and North-East India appear to DR. HOPE to be largely wrong or inadequate.

The memorandum referred to is illustrated by diagrams which help to more fully explain the systems of terraces, catch trenches and leguminous hedges as well as the draining of slopes.

C. D.

EFFECT OF TEMPERATURE ON CAPILLARY MOISTURE IN SOILS.

G. J. BOUYOUCOS.

The diurnal change of temperature gradient of the soil gives rise to a change in surface tension and viscosity of the soil moisture, and since capillary action is dependent upon surface tension and facility of movement upon viscosity there should occur an upward and downward movement of soil moisture corresponding to the diurnal changes in temperature gradient. Thus, during the day when the temperature of the soil is highest at the surface and diminishes with depth the surface tension and viscosity of soil moisture will be lowest at the surface and will increase with depth, consequently the movement of moisture should be downward. During the night conditions are reversed and hence the water translocation should be upward.

The object of these investigations was to determine the validity of these deductions. The method of procedure consisted in placing soils of different but uniform moisture content in brass tubes 8 inches long and 1½ inches in diameter closing both ends with solid rubber stoppers and keeping one half of the soil column at a high temperature and the other half at a low temperature for a certain length of time, then determining the percentage of moisture of the two columns, any difference in water content being attributed to thermal translocation. The movement of moisture from warm to cold soil was studied with the column in a horizontal and also in a vertical position.

It was found that when the same percentages of moisture were employed practically the same results were obtained whether the tubes were placed horizontally or vertically. When one half of the soil column is maintained at a temperature of 20° or 40° C and the other half at 0° for eight hours the percentage of water moved from the warm to the cold soil increased with increase in water content in all the different types of soil up to a certain point after which it decreased with further increase in the water content of the soil. The moisture content at which the maximum thermal translocation of water occurred is different for different soils but the percentage of

water transferred is the same for all classes of soil for any one of the temperature amplitudes. The percentage of moisture at which the maximum thermal translocation occurs is known as the "thermal critical moisture content."

These results being contrary to expectation, it is therefore concluded that the capillary movement of water in moist soils is not controlled entirely by the curvature of the capillary films as is generally believed, but also by the unsatisfied attractive forces of the soil for water.

The possibility of thermal movement of soil moisture occurring by evaporation and condensation was then investigated. The formation of dew is attributed to the rising of vapour or moist air from the warmer soil below to the colder soil above where it is condensed. To test this possibility the tubes were filled with soil so as to leave a column of air in the middle portion. One half contained moist soil at temperatures of 20° and 40° and the other half dry soil at a temperature of 0°. The percentage of moisture distilled over from the moist warm soil to the cold dry soil in 8 hours was insignificant for both amplitudes of temperature and was about the same for all moisture contents.

It is therefore concluded that the amount of water lost from the soil in the form of vapour is very small, that there is no rising of vapour during the night from the warmer soil below to the cold soil above and that the water of the dew was not derived from the soil vapour, as is commonly believed.

A dry layer of soil is often used as a mulch to reduce the evaporation of water from the subsoil. This action is attributed to the break in the capillary connections between the surface layer and moist soil below. Since the adhesive and absorptive forces of a solid substance decrease with rise of temperature the question arises as to whether the dry mulch with a high temperature would absorb moisture from a moist soil at a low temperature even when the capillary connections were ideal. To investigate this point brass tubes were filled with soil, one half with dry and the other with moist soil with a circular piece of cheese cloth between to facilitate their separation. When the moist column was kept at temperatures of 20° and 40°C and the dry column at 0° for 8 hours the amount of moisture moved from the moist warm soil to the dry cold soil increased with temperature and moisture content. But when the moist soil was kept at 0° and the dry soil at 20° and 40° little if any movement of water occurred. It is therefore concluded that temperature has a very marked influence on the conservation of moisture by mulches. A high temperature promotes the formation of a mulch and tends to conserve the soil moisture in the deeper layers.—BULL. INT. INST. OF AGRIC.

INFLUENCE OF WEATHER AND SEASONS ON SOILS.

E. J. RUSSELL.

Spring has always been recognised as the great time for life in the soil. "It is then," says VIRGIL, "that Aether, the Almighty Father of Nature, penetrates the womb of earth with his fruitful showers and, blending his mighty frame with hers, gives life to all the embryos within."

The summer minimum may be attributed to dryness, and the autumn maximum to a repetition of the spring effects. In a moist warm summer, however, continued activity may occur right up to the point when "sickness" sets in, and the autumn maximum may not then arise.

In consequence of these various activities the soil is left pretty rich in nitrates at the end of autumn provided the summer has been reasonably dry. If these remain they form a good supply for the young plants of the following season. But in a wet winter part is washed out and the young plant is deprived of some of its food. We thus have part of the explanation of the harmful effect of a wet winter, and one of the reasons why the husbandman in all ages has hoped for dry winters. "A wet summer and a fine winter," to quote again from the GEORGICS, "should be the farmer's prayer. From winter dust comes great joy to the corn, joy to the land. No tillage gives Mysia such cause for boasting, or Gargarus for wondering at his own harvest." English farmers would ask for the wet spring instead of the wet summer, but they would agree entirely as to the winter, and out of their experience they have evolved a variety of similar expressions. Again the man of science has annotated the poet, and SIR WILLIAM SHAW has worked out a mathematical expression showing how much damage is done on an average by winter rain.

The trouble can be met by a system of green manuring, whereby plants are grown in the autumn to take up the nitrates and are then ploughed into the land ready for the operation of the soil organisms in spring. The system is very sound, and as soon as it is sufficiently developed to fit in with our present rotation it may be confidently expected to play a considerable part in helping the farmer to struggle against bad weather.

Table showing the Effect of Wet and Dry Winters respectively on the Yield of Corn at Rothamsted.

	Rainfall: October-March.	Yield of grain, bushels to the acre		
		Ammonium Salts applied.		Difference in favour of Spring dressing.
		In Autumn	In Spring	
*Dry winter ...	11·73	31·8	32·5	0·7
*Wet „ ...	16·73	27·5	32·5	5·0
	Total produce (grain and straw), lb. to the acre			
Dry winter ...	11·73	5,631	5,829	196
Wet „ ...	16·73	4,932	6,004	1,072

SOIL TREATMENT.

PROFESSOR OWEN, of the Louisiana State University, has recently been drawing attention in *Sugar* to a new aspect of the case as regards the beneficial effect of heat and disinfectants on soils. The RUSSELL and HUTCHINSON theory is that these agents destroy the malignant protozoa in the soil, and

* The dry winters were those preceding the harvests of 1889, '90, '91, '93, '98, 1901, '02, '03, '05, '06, '09, for which the results are averaged here; the wet winters were those preceding the harvest of 1892, '94, '95, '96, '97, 1900, '07, '08, '10, '11,—JOUR. OF THE ROY. HORT. SOC.

thus give the surviving beneficent bacteria full liberty of action in the direction of providing a supply of utilisable food for the plant. As against this PROFESSOR OWEN adduces the results of the work of GREIG SMITH in Australia and of MESSRS. KELLY and MCGEORGE in Hawaii.

The former experimenter claims that the beneficial effect of heat is entirely independent of its action upon soil protozoa, and that he has found the same benefits are obtained in soils which had been previously freed of living protozoa before the heat was applied. SMITH maintains that the good results obtained from heating the soil come from the destruction of bacterial toxins in the soil, which, produced by bacteria in the course of their development, tend later to limit the further development of these micro-organisms. By heating the soil this inhibiting factor is destroyed, and the soil bacteria are enabled to increase more rapidly.

A difficult point about SMITH's theory is the fact that certain volatile disinfectants act upon the soil in the same way as heat does. The explanation he gives of this is that soils contain a waxy body which coats the soil particles. This is dissolved by the carbon-bisulphide, chloroform, or toluol used, is carried to the surface of the soil, and is there deposited by the evaporation of the solvent. In this way the nutrient material of the soil, before not get-at-able, is made available. This theory, it will be noticed completely separates the fertilising action of heat from that of disinfectants.

MESSRS. KELLY and MCGEORGE applied themselves entirely to the heat question, and found that the increase of ammonia following treating was very striking. The soil was treated from 150° to 250°C. and under pressure of two atmospheres. The ammonia content of the soil materially increased up to 200° C., from which point it decreased. There was also a considerable decrease in nitrate nitrogen, which was found to begin at a temperature of 150° C. The nitrates were completely destroyed at a temperature of 200° to 250° C. The solubility of soil nitrogen was also considerably increased.

When the soil was dried at 100° C. an increase in the water soluble manganese, lime, magnesia, phosphoric acid, sulphates, and bicarbonates resulted, and in about 50 per cent. of the cases an increase in the water-soluble potash occurred. The theory advanced by MESSRS. KELLY and MCGEORGE as to the action of heat upon soils is that the soil is so altered in its physical condition that the film pressure is destroyed, and the solvent can establish more intimate connection with the soil constituents. This theory is rather in accord with GREIG SMITH'S.—WEST INDIA COMMITTEE CIRCULAR.

THE EFFICIENCY OF PHOSPHATES.

H. G. SODERBAUM.

Previous workers have shown that the fertilising value of insoluble phosphates (bone meal, tricalcium phosphate, phosphorite, etc.) depends largely on the quantity of lime contained in the soil. A more detailed experimental enquiry into this problem soon gave numerous results showing the existence of other factors of a nature hitherto unexplained, capable of diminishing or increasing the efficiency of insoluble phosphates and also perhaps of phosphates in general. The attendant factors affecting growth were considered to be: partly the form of the nitrogenous manure added at

the same time, partly the amount of magnesia in the soil and its relation to the amount of lime and phosphoric acid present. These factors are considered as the *nitrogen factor* and *magnesium factor*.

To determine the influence of these two factors, under various conditions, on the yield of the crop, 10 years experiments have been made with oats, barley, rye and wheat in a sandy soil ("Diluvial sand") sufficiently poor in nitrogen and phosphoric acid. The crops were grown in glass vessels containing from 52 to 66 lb. of the soil. The results obtained showed that: replacing nitrate of soda by ammonium salts (nitrate or sulphate) gave quite different results according as the added phosphate was soluble or insoluble. In the first case when the phosphoric acid was added as superphosphate, basic slag or bicalcium phosphate the change of nitrogenous manure did not cause much difference in the results. In the greater number of cases a slight depression was observed and in one case only a slight increase in yield.

When the phosphate applied was in the insoluble condition the results were quite different. Replacing nitrate of soda by ammonium salts caused without exception a more or less great increase in the yield of oats, rye and wheat. With barley however no increase in yield was observed, but more often a decrease which reached a maximum with the exclusive use of ammonium salts (i.e. in absence of nitrates). Compared with ammonium salts, organic nitrogen (as urea and albumen) produced less marked effect. The singular behaviour of barley was also evident in this case. Thus, whilst urea applied to oats in place of nitrate gave only a slight increase or none at all, in the case of barley there was a distinct decrease in the yield.

Matters were somewhat more complex when the magnesium factor was modified (by the addition of sulphate or carbonate of magnesia). With soluble phosphates, irrespective of the nitrogenous manure, the addition of magnesium sulphate when it produced any effect sometimes caused a decrease and sometimes an increase in yield.

No definite or marked effect in any one direction could be observed. When, on the contrary, rye or wheat was manured with superphosphate or sulphate of ammonia the addition of equivalent of magnesium carbonate to one or another of the ammonium salts caused a considerable increase in yield. With insoluble phosphate, sulphate of magnesia, in all cases where action occurred, either increased or decreased the yield, whilst carbonate of magnesia applied with ammonium salts always favoured the growth of winter cereals, at least when the ammonia was added as sulphate.

From these experiments and those of previous workers the following practical conclusion may be drawn: When phosphoric acid is applied as superphosphate, basic slag or bicalcio phosphate, the replacement of nitrate of soda with sulphate of ammonia apparently produces no appreciable advantage. When however tricalcio phosphate, bone meal, and phosphorite are applied with ammonium salts much better results are generally obtained than when applied with nitrate of soda. These differences which are considerable in pot cultures would also be apparent on a large scale.

The results seem to show also that the fertilising action of insoluble phosphates depends also on the amount of magnesia in the soil, an excess of deficiency which is equally injurious in this respect. In one field the addition of magnesium salts may be very beneficial whilst in another the yield may be considerably diminished. The various crops, either of the same or of different families appeared to have a very different sensibility relative to the variation in the amount of magnesium. It is therefore necessary to make preliminary experiments in the field of a local nature to determine in each case the magnesium requirements of a given plant in any particular soil before a magnesium manure can be recommended.

In every case the consideration of the lime factor cannot be regarded as sufficient when insoluble phosphates are applied. The *nitrogen* and *magnesium* factors must also be taken into account. By a consideration of all three factors it is possible to increase the fertilising value of the phosphates in question by rendering them equal to or less inferior to soluble phosphates.—BULL. INT. INST. OF AGRIC.

JADOO FIBRE.

The following is the analysis made by Mr. J. C. BRUNNICH, Agricultural Chemist of the Queensland Department of Agriculture, on this material, and, published in the AGRICULTURAL JOURNAL of that Colony:—

I found Jadoo fibre to be a fine fibrous product, of brownish colour, which, almost like a sponge, has the power of absorbing an enormous quantity of water, up to six to eight times its own weight. This fact alone will explain part of its practical value, when used for pot plants, in the orchard or vineyard. This fibrous raw material is saturated with plant foods, which, according to analysis, are to a large extent soluble in water, any plant having thus a fair amount of plant foods at once available for its growth; other portions of the plant foods are, like some in the soil, not soluble in water, but soluble in hydrochloric acid, and these will become available gradually by the chemical dissolving action possessed by the roots of growing plants. As a matter of fact, Jadoo fibre must be considered a highly fertile artificial peaty soil.

ANALYSIS.

	Per cent.
Organic matters	71·40

Containing ·812 per cent. of Nitrogen=·986 per cent. Ammonia.

Mineral matters—

Soluble in water (total, 4·36 per cent.)

	Per cent.
Phosphoric acid, ...	·445
Sulphuric acid, ...	1·286
Nitric acid, ...	·520
Alumina and iron, ...	·271
Lime, ...	·303
Magnesia, ...	·107
Potash, ...	·357
Soda, ...	·750
Ammonia, ...	·020

Soluble in hydrochloric acid, 1·1 sp. gr.

	Per cent.	
Silica, ...	·031	
Sulphuric acid, ...	·926	
Phosphoric acid, ...	·715	
Alumina, ...	·765	
Iron, ...	·170	
Lime, ...	1·875	
Magnesia, ...	·163	
Potash, ...	·402	
Soda, ...	·791	
	5·838	
Insoluble in HCl	4·012	
Total ash		9·85
Moisture		18·75

"The inventor does not claim the product to be a manure, and in accordance with the analysis, the actual value of the plant foods, phosphoric acid, potash, and nitrogen amounts to 15*s*. per ton of Jadoo fibre. The secret of the preparation lies in the foundation material, which has the power of absorbing and retaining the fertilizing ingredients, which are thoroughly incorporated with the fibre by a slow process of fermentation.

"I believe the manufacture of this product could be successfully started in this State, and I do not think that a better foundation material could be found than finely crushed megass from a sugar-mill. Megass by itself has only a slight manurial value (about 6*s*. per ton), but it possesses great absorptive power, and retains water just as well as Jadoo fibre; and, again does not rot quickly in the ground. Perhaps finely chopped trash, or, again, dried filter press cake, might be added with advantage to the megass."

[In Ceylon Coir Dust should be a suitable foundation material.—Ed. *T.A.*]

ERZRUM AND THE TEA TRADE.

The Russian advance into Asia Minor is a factor of considerable importance to the tea trade, for the Russian Board of Agriculture and State Domains, within the last few years, has been energetically developing the tea plantations along the Black Sea shore. The Governments (States) of Kutais and Batum are the present centre of this development. So marked have been the favourable results of the Government's assistance to tea growing that in the last eight years the increase on the Government of Batum alone was from 638,605 pounds (Russian) of tea to 1,332,866 pounds (Russian). It is interesting to note that covering this same period the number of plantations had increased from 39 to 146, and that the acreage had been more than doubled.

In the Kutais Government a number of experimental stations have been established for the determination of the varieties of tea most suitable for growing in these districts.

In addition these experimental stations send out lecturers and experts to teach the peasants the best ways of preparing the raw leaf. A large tea factory has also been opened in Zvani, whither the peasants bring their leaves immediately after plucking, if they do not feel themselves competent to prepare the product for market. One of the functlous of this factory is to establish a definite standard for the tea, as without such a standard the quality of the product prepared by the peasants is very unequal. This training of the peasants in tea growing and preparation is but one small phase of the gigantic industrial education of the peasant, which is known as the National Koustar Movement.

Not only did Russia want more southern territory, but the ability to utilize the labour resources of the peoples of Asia Minor will do much to develop the tea trade. Up to the present time the greatest handicap to making Transcaucasia a great tea-growing centre has been the sparseness of the population and the consequent scarcity of labour. In China, for example, the pay per day varies from 12 to 16 kopecks (6 to 8 cents), whereas in Transcaucasia the pay reaches as high as 70 kopecks to 1 rouble, or 35 to 50 cents. The tea, however, that is grown under Government supervision is of a very high quality. As Russia is one of the largest consumers of tea, the possibilities involved in an extension of territory are very great.—TEA AND COFFEE TRADE JOURNAL.

SERICULTURE.

SERICULTURE IN SOUTH INDIA.

T. V. RAMAKRISHNA AIYAR.

(*Continued from p. 334, Vol. XLVI.*)

Mulberry.—During the 2nd month after planting the cuttings put out shoot and at this time the soil around is weeded by hand or bullock hoes. Leaf picking to feed silkworms is begun from the fifth month onwards. This may be early or late according to the quality of the land, the amount of cultivation, manuring and the timely rains. Every subsequent year either before or soon after the first rains the plants are pruned flush to the level of the ground. After pruning, the soil is raked up either by hoes or by ploughs and a handful of manure applied to each set of stumps; some apply a few cartloads and mix it up with the soil. The usual weeding is done about two months after pruning. Cattle browse on mulberry leaves, but the Kollegal farmer does not make any provision in the way of trenching or fencing around his fields. Mulberry plots in this way keep on from six to ten years in this tract. As years follow the attention paid to the plot becomes less and less and with it the yield of foliage falls down considerably. A general idea of the operations connected with mulberry cultivation and the rough average expenditure on one acre of land in Kollegal may be had from the following statement:—

Ploughing in summer 5 times at Re. 1	...	Rs.	5 0 0
Manure 12 cartloads at 8 as.	...	,,	6 0 0
Planting { 1 plough ...	...	,,	0 8 0
Planting { 6 men to prepare cuttings and planting at 4 as.	...	,,	1 8 0
Watering if rain fails ...	...	,,	2 0 0
Hoeing and weeding 2 months after planting		,,	2 0 0
	Total...	Rs.	17 0 0

Subsequent years :—

Pruning ...	...	Rs.	1 0 0
Ploughing (3)	...	,,	3 0 0
Manure 5 carts	...	,,	2 8 0
Weeding	...	,,	2 0 0
	Total...	Rs.	8 8 0

In Berigai, as stated once before, we do not find any extensive cultivation of mulberry or silk rearing as in Kollegal. The area under mulberry in this place for the fasli 1319 = 1910-11 occupies 15·49 acres and almost the whole of this area is around the village of Berigai and arranged in big blocks. One important difference between Kollegal and Berigai in the matter of mulberry cultivation is the fact that in Berigai the mulberry grower, the silkworm rearer and the reeler are one and the same person. There is hardly any exception to this rule, as such great attention is paid to the preparation of the land, etc., so that one may get plenty of good leaves. Another feature in this place is that each cultivator takes up small plots of land instead of large areas and rears as many worms as he can from the foliage got. Three *guntas* or 3/40 acre is the typical area taken by each cultivator. The mulberry lands in Berigai have more or less the character of garden lands. The preparation of

the soil for planting cuttings is more thorough and far superior to that done in Kollegal, though of course a great deal more expensive. Instead of ploughing, the land is dug up to a depth of 18 in. by means of *kudalis* or local crowbars in April and May, just as is done for sugarcane planting. The dug-up clods are allowed to dry for about a month. A second digging is now given and a week or fortnight; after this the clods are well broken and the land levelled. Lines are made in the soil and holes made for planting. Generally channels for irrigation are made along the sides and through the centre of the plot. Cuttings are obtained for nothing as in Kollegal and the pieces 8 in. or 9 in. in length are planted 3 or 4 in each hole, the holes being 1 or 1½ feet apart. As in Kollegal the cuttings are not thrown flat in the soil and covered up but planted as usual. Unlike as in Kollegal the holes are nearer to each other also. There are in Berigai also two varieties of mulberry known, viz., the *sultani* or *Natti* and the *Chittoor*. The former is said to be the better variety but since the latter yields more foliage, it is grown more commonly. Manuring the land is done by some when the land is being prepared just before planting, while some others apply it a month or so after planting. Generally from six to ten cartloads of manure are applied for an area of three guntas, 3/40 acre. A month or 40 days after planting spading of the soil is done around the cuttings and this corresponds to the hoeing and weeding of Kollegal. There are facilities for irrigation in this locality and some of the mulberry lands are well irrigated. Leaf picking begins by the 4th or 5th month. Every subsequent year pruning takes place and sometimes when there are good irrigation facilities the plants are pruned twice a year, once in February and again in July. After every pruning the soil is dug around the stumps and two or three cartloads of manure are applied. Some of the growers also keep nurseries of cuttings watered and transplant them when rains come in or facilities for irrigating the fields occur. To prevent cattle from feeding on the foliage the owners of adjacent mulberry lands all contribute something and build fences around a big area of mulberry. Those who could afford enclose their own fields. In this manner mulberry plots are kept up in good condition for over 30 or 40 years.

STATEMENT OF OPERATIONS AND ROUGH ESTIMATE OF EXPENSES.

The standard area here is three guntas or 3/40 acre and the estimates are for this area.

First digging of land in April-May, 8 men at 4 as.	Rs.	2	0	0
Second digging in June, 6 men ...	,,	1	8	0
Breaking of clods and levelling a week before planting, 2 men	,,	0	8	0
Preparing lines, making cuttings and planting, 6 men	,,	1	8	0
Manure, 8 cartloads at 8 as.	,,	4	0	0
Weeding and spading in August and September, 2 men	,,	0	8	0
Total...	Rs.	10	0	0

Subsequent years:—

Pruning, 1 man	Rs.	0	4	0
Digging, 3 men	,,	0	12	0
Manure, 4 carts	,,	2	0	0
Total...	Rs.	3	0	0

Calculating from this statement for one acre the initial expenditure comes to Rs. 133-5 4 and every following year Rs. 40.

POULTRY.

THE UTILITY HEN.

As regards the question of profit, we believe that the average person who takes up utility poultry-keeping in a scientific manner will stand a better chance of making money than the average fancier. It is perfectly true that one often hears of birds changing hands for immense sums and many fanciers do make large profits every year, but it has to be remembered that years of experience and a good deal of preliminary expenditure has to go to make this happy result. In order to rear one first-class winner, a hundred chickens may have been reared, and there are always heavy items, such as railway fares, special feeding, housing, entrance fees, and baskets; and v.h.c.'s do not pay the expenses. The beginner may read enviously of the wonderful success gained by So-and-So's birds, and the high price obtainable for stock from his yards, but it must be remembered that it takes years—except in exceptional cases of good luck—to build up a standing reputation in the Fancy. The breeding of fancy fowls is, at the present moment, owing to the ever-increasing competition, and to the highly-scientific methods used, a difficult as well as an extremely fascinating pursuit.

Now to return to the utility side of the question. It is a fact that the utility poultry-keeper has a certain lurking grudge against past methods of the "Fancy." It was a very common custom some years ago, before scientific utility methods came into being, for fanciers to dispose of their mis-marked exhibition cockerels to fanciers and others for the purpose of improving their frequently mongrel stock. The improvement was unfortunately not manifest, for though the outward appearance of the barn-door fowl was doubtless improved, its egg yield was considerably lowered, owing to the fact that the cockerels had not been bred for laying purposes. In this way the "Fancy" got into ill repute, and people preferred to continue the management of their fowls in the old way. *It is difficult to realise to-day that until quite recently it was almost a matter of impossibility to obtain really first-class utility stock, so much had the poultry industry become one-sided.*

With better knowledge of the laws of heredity and a realisation of the importance (so necessary in all branches of stock-raising) of obtaining size, with improved methods of feeding and housing, and, above all, with the aid of trap-nesting system, efforts were made and are now brilliantly successful in building really valuable utility birds. This was the first advance to a general recognition of the principle that prize and utility birds are two distinct and separate things, and should be kept just like two distinct varieties.

The utility poultry-keeper of to-day, while endeavouring to keep his birds true to type, sets up as his ideal inward, not outward, qualities, and while a fancier would throw out of the breeding pen a mismarked pullet of good laying qualities, in favour of a better marked specimen of very indifferent laying powers, because the latter would be to him so much the more valuable bird, the utility poultry-keeper would proceed on exactly opposite sides.

In building up a strain of first-class layers, i.e., purely utility stock, everything (up to a certain point) but the reproductive qualities of the stock must go to the wall. The power of egg-production in a great degree is undoubtedly hereditary, and by trap-nesting, a careful record of the produce of each hen (that is the number of eggs laid, the months in which they were laid, and the age at which the hen began to lay), and using only the best as breeders, is the successful way to build up a great laying strain.

Roughly speaking, the utility hen may be divided into three classes: the layer, the table fowl, and the general purpose fowl. The first has been bred simply and solely for the purpose of producing as many eggs and as of good a size as possible. Edible qualities have been ignored, and the hen may be regarded merely as an egg machine. The effect of the systematic breeding for egg-production has been to increase enormously the egg yield of many strains during the last few years. Egg yield is not a matter of breed, but of strain, and the capacity can be heightened or decreased in any breed by suitable breeding.

The method known as "lining" a fowl is a pretty good test into which class a bird ought to be placed for its economic qualities. If an imaginary line is drawn through the centre of the body from the place where the back and neck meet, to the legs, it will give us in a very simple manner, in a yard full of hens, the exact type that is wanted. If the greater part of the body is behind the line, it denotes that the bird will be of the laying, not table breed, the egg organs being at the back. If the greater part of the body is before the line, then the bird will be of the good table class; while one evenly balanced denotes a good general purpose bird.

For the production of really good table stock, just as much concentration of energy is necessary in building up a strain as in the matter of layers. The whole production of table birds, from hatching to marketing, requires, indeed, a good deal of knowledge, more than the matter of commercial egg-production, but for those who have the skill and are suitably situated, there is a splendid opportunity. We could increase our yearly output of eggs and table birds many times over, and yet be behind the demand for really first-class stuff—only it must be first-class. Probably the farmer is likely to make the greatest success owing to his special advantages with the sale of eggs and birds for table, but one has only to look at the Sussex table bird industry to see what can be done by breeding, rearing, and fattening on the right lines, using the right class of fowl and producing at the right time.

Pedigree utility stock that can be guaranteed will always find—like pedigree exhibition stock—a ready sale, but, of course, a reputation has to be built up in this line as in any other, and patience and perseverance have to come into play before the really first-class strain is evolved. It is most disheartening to find the labours of several years' breeding for egg production thrown away by the introduction of a cock from an unknown ancestry, and this can be avoided if the bird is purchased from a strain of good layers.

Finally, the beginner should, if he enters both the Fancy and the Utility sections, keep each separate, for the objects of each are so widely divergent that any attempt at amalgamation will inevitably spell failure in both. Discouragement will follow, and in all probability a promising fancier and enthusiastic poultry farmer will be lost to the cause for ever.—South African Poultry Magazine.

MYCOLOGY.

REPORT OF THE ACTING BOTANIST AND MYCOLOGIST.

The Botanist and Mycologist in addition to his own duties acted as Entomologist, on the death of MR. A. RUTHERFORD, from January 19th to August 1st. He left Ceylon on leave on August 16th and was still on leave at the close of the year. The Assistant Botanist and Mycologist acted as Botanist and Mycologist during the latter's absence. An accident, sustained while inspecting disease of *Hevea* in the Ratnapura district, confined the Assistant Botanist and Mycologist to Hospital from September 24th to November 5th. During this period the correspondence was attended to by the Rubber Research Chemist; diseased specimens sent in were examined by the Field and Laboratory Assistant.

MR. A. G. ALWIS was confirmed in his appointment as Photographer and Draughtsman on May 1st, 1915.

2. The total number of in and out letters for the year was 1,885 Consignments of disease specimens for examination numbered 114, of which 44 were of *Hevea brasiliensis* and 44 of tea: the remainder included albizzia, avocado, betel, brinjal, chili, cinnamon, coconut, coffee, lime, orange, plantain, prickly pear, sesame, tephrosia, tobacco, tomato and grape vine.

3. Specimens of diseased plants for examination and report have been received from South India, Malaya, Burma, Uganda and Seychelles.

Requests for specimens of Ceylon diseases have been received from Malaya, Uganda, Gold Coast, India, Great Britain, etc., and have been complied with as far as possible.

4. The Botanist and Mycologist carried out important systematic work in connection with the Ceylon Fern Flora, on material collected by him at Hakgala and Horton Plains.

5. Visits have been made by the Assistant Botanist and Mycologist to Chilaw, Rambukkana, Ratnapura (thrice), Kalutara (thrice), Kegalle (twice), Matara, Elpitiya, Kadugannawa, Matale, Wattegama and Ulapane districts, the total number of miles travelled during the year being 2,200.

FUMIGATORIUM.

6. During 1915 1,173 cases of tea seed, 602 cases of citrus fruits and 396 miscellaneous packages of plants were treated at the Fumigatorium.

HEVEA.

7. The specimens of *Hevea brasiliensis* sent in for report showed that in prevalence the diseases occupy the same relative position as in former years. Taken all over, there appeared to be a general diminution of disease.

8. The "canker" fungus, *Phytophthora Faberi*, again heads the list. Pod disease caused by this fungus was severe in some districts in July: this was accompanied by heavy leaf fall owing to the spread of the fungus to the leaf stalks. This condition has recently been reported from South India. Canker of the stem in its early stages has been effectively treated by light

scraping and treatment with a 20 per cent. solution of *Carbolineum plantarium* in water. Canker at the collar was found in the Matara district, where it had nearly ringed several trees. By early and vigorous treatment it should be possible to lessen to a considerable extent the ravages of this fungus.

9. Towards the end of the year *Fomes lignosus (=Fomes semitostus)* was reported on several occasions from the Kelani Valley. Drastic removal and burning of diseased roots and jungle stumps where these still occur in rubber clearings would reduce the losses from this cause.

10. Decay of the renewing cortex or "Bark Rot" was somewhat prevalent about July and November, during the wet weather experienced in those two months. In December experimental work was initiated in connection with this disease. Inoculations of the freshly tapped surface of healthy trees with diseased bark yielded no cases of infection. Treatment with 20 per cent. water solution of *Carbolineum plantarium* appeared to mitigate the severity of fresh attacks, but had no immediately apparent effect in arresting bark already affected.

This disease appears to be capable of explanation on purely physiological grounds.

Treatment of diseased areas with clay and cowdung mixtures is being tried as a means of accelerating the process of occlusion of exposed wood surfaces.

11. A case of *Poria hypolateritia* killing young Hevea and Tephrosia, the latter having been interplanted as a green manure, was observed on the Experiment Station at Ganoruwa.

12. A case of *Collototrichum ficus* was recorded on Hevea leaves.

13. An investigation into the formation of latex cells was commenced in conjunction with the Rubber Research Chemist in August 1915. This research will cover a period of at least one year in order to allow of observations being made in various seasons of the year.

Observations made on samples of bark from numerous trees indicate that the number of rows of latex cells varies to a considerable extent according to the height from the ground.

14. The summarizing of the Hevea tapping experiments at Ganoruwa and Henaratgoda was continued by the Botanist and Mycologist and departmental bulletins were published on the Ganoruwa tapping results and on the effect of different intervals between successive tappings on results obtained from Henaratgoda.

TEA.

15. The usual diseases of tea have been reported. *Poria hypolateritia* continues to cause much root disease in new clearings. One very bad case of *Cephaleuros virescens* on branches was recorded: in this case branches up to half an inch diameter were attacked.

16. The Botanist and Mycologist, in the course of inspecting diseased tea on an Up-country tea estate, collected specimens of *Corticium salmonicolor* (pink disease) on tea branches, where this fungus was undoubtedly the cause of "branch canker."

17. A large number of insect pests on tea sent in by various estates were examined and reported on.

18. Two tea stumps were received from an estate in the Dehiowita district. They had been growing in a field where Hevea was interplanted in tea and the latter then allowed to die out. The stumps were covered

with white mycelium and bore fructifications of *Fomes lignosus*. There was no sign of previous root disease on tea, but it may have been killed by *Botryodiplodia*.

19. Leaf diseases of tea recorded include the usual attacks of Grey Blight caused by *Pestalozzia palmarum*, and Brown Blight caused by *Colletotrichum camelliæ*.

20. A species of *Phæospæhrella* was observed on old leaves in the Peradeniya district. At first there are small irregular yellow spots, later becoming greyish and arid with a yellow green margin, finally the centre drops out leaving a small hole, but often these holes are confluent and extend over the whole length of the leaf.

21. Young plants from Rangalla which were shedding their leaves and dying, were found to have the leaves attacked by *Læstadia thcæ*, Rac, but the cause of the leaf fall was apparently Scarlet mite.

22. From Ratnapura and Pelmadulla districts diseased leaves with large, light reddish brown spots extending over the greater part of the leaf and running in between the veins showed the pycnidia of *Phoma camelliæ* Cooke.

23. Leaves damaged by bag worms showed irregular, raised, rough brown patches on the upper surface. In cross section it was seen that the epidermis was wanting over the patches, and an interesting pathological condition had supervened: a new layer of cells had been developed within the palisade layer, cutting off the exposed part.

COCONUTS.

24. Cases of Bud Rot were recorded from the Experiment Station, Ganoruwa, where a number of young coconut palms were killed off. The appearance of Bud Rot among coconuts calls for drastic and immediate treatment, on the lines already laid down by the Department. A case of *Fomes lignosus* on *Hevea brasiliensis* and mycelial strands, very closely resembling those of *Fomes lignosus* on the roots of an adjoining coconut palm, is still under observation.

25. Considerable difficulty has been experienced in obtaining cultures of the Rhinoceros Beetle fungus, *Metarrhizium anisopliæ*, on a sufficiently large scale to allow of field experiments with the fungus in Beetle traps, owing to the ubiquitous presence of a small Phorid fly. The departure of the Botanist and Mycologist necessitated the postponing of field work on account of the increased amount of time required for office work.

26. A leaf disease caused by *Helminthosporium sp.* was recorded from some leaves sent in for examination.

27. An inflorescence taken from a palm in the Dambadeniya district contained green skinned nuts and yellow skinned nuts. Two of each kind were planted, but only one of each kind germinated. These seedling palms are still being kept under observation.

28. Articles were published by the Botanist and Mycologist in the Annals of Peradeniya on "Some abnormalities of the Coconut Palm" and "The Effect of Lightning on Coconut Palms."

PLANTAINS.

29. The Botanist and Mycologist has recorded the following diseases of plantains during the past year. The root disease of plantains mentioned in the last two annual reports is still under investigation, A disease of green fruits from the Experiment Station, Ganoruwa, was examined: the disease

spreads from the older fruits on the bunch to the younger. At first the fruits show slate coloured or lavender areas with a yellow margin, which later become black and densely covered with reddish-pink spots, which are the fructifications of the causative fungus *Glœosporium musæ*, Cke. and Mass.

30. In another disease of green fruit from the Experiment Station, Ganoruwa, the fungus was identified as *Macrophoma musæ* (Cke) Berl. and Vogl. The green fruits are covered with the minute black pycnidia of the fungus so closely that the surface in places is quite black.

31. A *Fusicladium* was found on dying leaves from the Experiment Station. These diseases can readily be kept in check by collecting and burning the diseased parts.

COFFEE.

32. A twig disease was observed on Liberian coffee on the Experiment Station, Ganoruwa. The twigs turned blackish-brown from the top downwards, and showed minute oval spots. The fungus found corresponded closely with *Collototrichum incarnatum*, Zimm., which causes a branch disease in Java.

TOBACCO.

33. A tobacco plant forwarded for examination from Negombo was found to be attacked by *Bacillus solanacearum*.

A "damping off" disease of seedling plants was sent in from Matale. The plants were in a bad condition, and no definite disease causing organism could be identified.

Plants received from the Tobacco Planter were attacked by a *Fusarium*.

CITRUS.

34. A disease of immature orange fruits caused by an *Oospora* was investigated: the fruits turn yellow but internally are quite undeveloped. Sodden watery looking patches occur, on which appear a white mould.

35. The *Oidium* disease or mildew of young leaves of Citrus species continues to be very common, and causes much damage. Preventive spraying with Bordeaux mixture could with advantage be carried out.

PAPAW.

36. Specimens from the Experiment Station Ganoruwa showed decaying roots and gradual shedding of leaves and fruits until only a tuft of small leaves remained, the tree finally falling over. *Sphærostilbe repens* was abundant in the stem at the collar, the rhizomorphs forming a tangled mass in the rotting tissue and extending into the sound tissue.

TOMATO.

37. A case of bacterial wilt of tomato was observed. Leaf curl was found on another lot of plants sent in for examination. The leaves were nearly all curled and dwarfed and the veins were thickened; a few local swellings were to be seen on the veins. Some of the leaves were pale yellow-green toward the margin or in patches between the main veins. Splitting of the green fruits occurred on these plants.

BETEL.

38. Various parasitic fungi were observed on a consignment of leaves from Madulsima. A *Colletotrichum* caused minute ochraceous spots: in addition *Phyllosticta piperis* Tassi, and a *Fusarium* were found.

BEET.

39. On beet growing in flower beds at Hakgala *Cercospora beticola* Sacc. was recorded.

PRICKLY PEAR.

40. Specimens of Prickly Pear from Vavuniya were received from the Government Agent, Northern Province. These had a heavy infestation of the Cochineal insect, and the plants thus weakened were being killed back by *Colletotrichum sp.* and *Glœosporium sp.* It was desired if possible to encourage the disease in the hope of eradicating the prickly pear to some extent. The results of the first endeavours to spread the disease were somewhat disappointing.

The usual difficulty encountered in similar work elsewhere is that sooner or later a balance is reached between the plant and its parasite, and the process of eradication thus comes to a standstill. It is different in the case of economic plants grown under more or less artificial conditions, which in the consequent disturbance of their powers of resistance are rendered more susceptible to disease.

MISCELLANEOUS.

41. A leaf disease of *Flacourtia inermis* growing in the Royal Botanic Gardens was caused by a *Pestalozzia* indistinguishable from *Pestalozzia palmarum*. *Pestalozzia palmarum* was found on *Vangueria edulis* also in the Royal Botanic Gardens.

42. Horse radish at Hakgala had its leaves attacked by *Macrosporium Herculeum*.

43. From Negombo *Zinnia* leaves were received which were curled and twisted and had swellings on the veins. This appeared to be a pathological condition not caused by any pathogenic organism.

44. Another case of branch canker of *Albizzia* with much distortion in the region of the disease was probably due to the *Nectria* which produces branch canker in *Acacia decurrens*. The state of development was too immature to allow of definite identification.

45. A fungus on timber was received from Ratnapura. This proved to be a common Ceylon fungus *Lenzites striatus*.

46. An *Oidium* on Chilli leaves was noted.

47. A *Fusarium* was identified as causing a disease of *Sesame* leaves in conjunction with a mining caterpillar on plants from the Experiment Station, Ganoruwa.

48. Cinnamon twigs and leaves badly attacked by *Cephaleuros sp.* (Red Rust) and a *Glœosporium* were received.

49. Avocado leaves attacked by *Cephaleuros sp.* were also recorded.

MYCOLOGICAL HERBARIUM.

50. About 400 Ceylon specimens have been added to the Mycological and Pathological Herbarium.

51. The Draughtsman and Photographer has added about 100 paintings and black and white drawings of Ceylon fungi and plant diseases to the general collection.

52. Mycological specimens have been supplied to PROF. C. F. BAKER (Philippines), PROF. J. C. ARTHUR (U.S.A.), PROF. R. THAXTER (U.S.A.), MR. C. G. LLOYD (U.S.A.), MR. W. SMALL (Uganda), MR. J. F. DASTUR (Pusa), MR. N. PATOUILLARD (France), MR. E. T. BROOKS (Kuala Lumpur and Cambridge), DR. A. RANT (Java).

53. A Revision of the Discomycetes was begun by the Assistant Botanist and Mycologist. BERKELEY and BROOME'S Ceylon type specimens in the Mycological Herbarium were critically examined and microscopic slides

were prepared from this material. Systematic collection in the field and description of the fresh specimens were taken in hand, but later had to be postponed owing to the pressure of other work on the departure of the Botanist and Mycologist on leave.

CEYLON FLORA.

54. Recent additions to the Ceylon Flora as aliens are the following first collected by the Botanist and Mycologist at Nuwara Eliya, in the course of an investigation into new weeds: *Prunella vulgaris* L. *Stachys arvensis* L., *Veronica serpyllifolia* L., *Erechtites valerianæfolia* D. C., *Salvia tiliæfolia* Vahl., *Sonchus arvensis* L., *Sesamum prostratum* Retz.

55. Two ferns new to Ceylon were collected in the Peradeniya district: *Gymnopteris tomentosa* (Lam.) Und., and *Ceropteris Calomelanos* (L.) Und. There is no record of the introduction of the first.

56. Several investigations of Ceylon and introduced plants reported in the last Annual Report are still in progress.

57. Phanerogamic specimens have been supplied to PROF. A. J. EWART (Victoria) and DR. M. BENSON (Royal Holloway College) and fern material to PROF. F. O. BOWER (Glasgow).

58. The collection of coloured drawings of Ceylon plants has been augmented.

59. In the Phanerogamic Herbarium were about 200 bundles of specimens of flowering plants and ferns collected in Ceylon during DR. WILLIS'S time. Of these 90 bundles have been systematically examined, and selected valuable specimens have been mounted and added to the Herbarium. About 4,480 sheets of foreign ferns of the late SIR A. C. LAWRIE'S collection have also been mounted and placed in the Herbarium. Thanks are due to the family of the late MR. GEO. WALL for the GEO. WALL collection of Ceylon ferns kindly presented to the Herbarium.

60. Material was supplied as usual for the Cambridge Local Examinations and for the London University Science Examination: the examination in Practical Botany in the latter was conducted by the Assistant Botanist and Mycologist.

61. 211 specimens were sent into the Phanerogamic Herbarium for identification during the year.

62. A white variety of *Centranthera procumbens* Benth. was forwarded by MR. F. LEWIS from Kiripitiya, N. W. P. In the course of the examination of this plant, it was determined that all the Ceylon species of Centranthera have spirally striate seeds, a character assigned by TRIMEN in 'Flora of Ceylon' to C. hispida Br. alone.

Psoralea corylifolia L. a species of Leguminosæ rare in the dry region was recorded growing in the Nuwara Eliya district.

64. *Cuscuta chinensis* Lam. only found about Colombo and very rare, was found growing in abundance on the hillside by the road to Ganoruwa. It was found on the following as host plants:—*Argyreia populifolia*, *Mikania scandens*. *Ocimum gratissimum*, *Sida rhombifolia*, *Mimosa pudica*, *Spondias mangifera*, *Ficus parasitica*.

65. The Botanist and Mycologist carried out a critical examination of the herbarium sheets of the genera *Sonchus* and *Blumea*, in connection with discrepancies that had been detected in the course of identification of species of the above genera.

66. Specimens of *Asytasia coromandeliana* Nees. with a dense covering of glands on the calyx and on the fruit wall were sent in by the REV. P. T. CASH

from Colombo. The presence of these glands is not recorded in the FLORA OF BRITISH INDIA nor in TRIMEN'S FLORA OF CEYLON.

LABORATORY.

67. The recent enlargement of the Laboratory and the acquisition of much needed apparatus has greatly facilitated work, and has widened the scope of laboratory research. Lack of an efficient heating system, however, as well as the incomplete condition of the water supply seriously limit work in important directions, such as sterilization of apparatus for infection work &c.

68. The increasing volume of correspondence in connection with examination and report on disease specimens from estates and other sources makes a serious demand on the time available for laboratory work, and renders the need of a clerk more and more pressing.

69. A small plot of land outside the laboratory has been enclosed, and is in use for germination and growth studies; in addition diseased plants can now be kept under daily observation without danger from straying cattle.

70. The card catalogue has been increased by over 2,500 cards and has been extended to include several new series of data.

PUBLICATIONS.

71. One number of the Annals of the Royal Botanic Gardens has been published during the year making the first number of Volume VI.

72. The following papers, articles, and notes have been published:—

A.—In the Annals of the Royal Botanic Gardens, Peradeniya:—The Pseudo-sclerotia of *Lentinus similis* and *Lentinus infundibuliformis*; Further Corrections and Additions to TRIMEN'S FLORA OF CEYLON 1893–1911; Some Abnormalities of the Coconut Palm; The Effect of Lightning on Coconut Palms; Horse-hair Blights.

B.—Bulletins of the Department of Agriculture:—The Effect of Different Intervals between Successive Tappings of Hevea brasiliensis, Henaratgoda Experiments; Hevea Tapping Results, Experiment Station, Peradeniya, 1914.

C.—In the Year Book of the Planters' Association of Ceylon:—Mycological Notes for 1915.

D.—In SPOLIA ZEYLANICA:—Note on the Extension of the Range of the Common Leech.

LIBRARY.

73. With the acquisition of a typewriter and special library type it has been possible to make a beginning with the typing of a card catalogue of authors, on standard cards. About 1,350 standard cards were completed and are ready for filing as soon as a card cabinet is obtained.

74. The compilation of the author's catalogue is now well in hand; the indexing of the periodicals was started and work on them is still in progress.

GEO. BRYCE,
Acting Botanist and Mycologist.

A DROUGHT RATION FOR COWS.

MR. B. A. BARR, Senior Dairy Supervisor, Victoria, reports having successfully adopted the following dairy ration for milch cattle when the country was drought-stricken, paddocks bare and bulky food scarce;—

8 lb. straw chaff (previously steamed)
8 lb. bran and 2 lb. coconut cake.

GENERAL.

BIRD-LIFE ON UP-COUNTRY TEA ESTATES.

The dearth of bird-life in the Up-country tea districts is mainly due to the lack of suitable cover. The average tea-estate is absolutely destitute of the kind of cover that insectivorous birds can live safely and breed in. Such plants as Grevilleas, Gums, Albizzias and Dadaps are absolutely unsuitable as cover for birds owing to their open system of branching and leafage which effectually discourages any bird which might think of nesting in any of them. The only time when any of these trees offer any suitable nesting—or even roosting—sites, is soon after they have been lopped and young branches have grown out bushily.

The type of cover most affected by birds consists of tangled thickets of close-foliaged bushy plants somewhat matted with berry-bearing creepers and with larger trees here and there to give shade and act as observation posts. Patches of such growth are very rare on estates owing, probably, to the fear that they would act as reservoirs of weeds. If intelligently planted up, however, there need be very little fear of their acting harmfully in this or any other direction.

It is admittedly desirable, both from the economic and æsthetic points of view, to have as much bird-life about as possible, and it seems strange that so little has been done in Ceylon to conserve and increase the number of individual birds and of species which frequent tea-estates. There is a tremendous field for work in this direction, and every planter not only can, but should, assist in this matter. Birds do not require very much encouragement to induce them to take up their abode near us. Give them suitable conditions and they will come naturally.

Anyone who desires to have his estate well populated by birds can do so without any undue expenditure of either time, money or labour. Any waste patches of land can easily be converted into excellent bird-sanctuaries by allowing natural harmless undergrowth to spring up, supplementing it with such berry-bearing shrubs as will grow in the district. A very good plant for this purpose is the Tallow-tree, *Sapium sebiferum*, Roxb., which bears small berries which are eagerly sought after by birds. In addition there are numerous wild berry-bearing brambles which are quite unobjectionable and give good cover as well as food. The Guavas (common and Chinese) are excellent for bird-attracting, but they unfortunately have an evil reputation as weeds. Conifers afford both food and excellent cover to many birds and they should be planted here and there.

If it is desired to go in for the higher branches of the art of bird attracting, artificial nesting-places can be erected in suitable localities. Nest-boxes can be made easily out of any small wooden boxes which need only have a small hole ($1\frac{1}{2}$ to 2 inch diameter) bored in one side of each to adapt them to the needs of many kinds of birds. Magpie Robins and Grey Tits will eagerly utilise such nesting boxes if set up in trees out of the reach of boys, etc. There is not such scope, however, in Ceylon for such methods of bird-attraction as in Europe or America, where far more species of hole-nesting birds exist. Winter-feeding is another method of attraction which cannot be carried out here, and putting out food promiscuously in the hope that the birds will find and eat it is not likely to lead to any increase in the bird-life of a locality in Ceylon, as natural food can be obtained by the birds themselves so easily.

It is not sufficient to merely provide good cover for the birds; they should be protected from their enemies as far as possible. Cats are, fortunately, almost a negligible item on most tea-estates except near the planter's bungalow, but unfortunately the Tamil podian is an even worse enemy of birds than the cat. No bird-sanctuary is safe from his depredations unless special measures are taken to prevent him from entering them. Barbed wire entanglements round the protected area and the fear of corporal punishment, administered by the Dorai, if caught nest-robbing, will probably minimise the danger from this direction; but nothing will entirely obviate it, so an endeavour should be made to induce the estate podians to come round to the planter's point of view. If the planter is sufficiently keen on bird-protection himself, his coolies are likely to become keen too.

Hawks and owls should not be shot unless caught in the act of killing poultry. All the species which frequent estates are practically harmless from the bird-protection and economic points of view, and they probably act beneficially in keeping down destructive rodents. Jungle-crows are valuable insect-destroyers and should be allowed to live on this account, despite their fondness for nestlings and eggs of other birds. Their numbers should be kept within reasonable limits, however.

Among the more valuable insectivorous birds which should be encouraged to live and increase on tea-estates, the following may be noted. A brief description of the usual nesting arrangements is given, so that suitable conditions may be arranged for each species:—

White-eyes *(Zosterops ceylonensis)*. Builds a small neat nest, four to ten feet from the ground, usually in a close-foliaged bush or shrub, and lay two or three eggs.

Minivets *(Pericrocotus flammeus and P. peregrinus)*. Also called Sultan birds. Builds neat nest in high trees as a rule. Albizzias attract these birds.

Bulbul *(Molpastes hæmorrhous)*. A fruit-eater, mainly, but a useful destroyer of insects. Nests in any suitable shrub. Two or three pinkish eggs, spotted and blotched with purplish brown.

Magpie Robin *(Copsychus saularis)*. Nests in holes in trees or buildings, etc.

Painted Thrush or Indian Pitta *(Pitta brachyura)*. A North-east Monsoon visitor to Ceylon. Loves tangled shrubberries. Does not nest in Ceylon.

Ceylon dull-blue Flycatcher *(Stoparola sordida)*. Nests usually in a hole in a mossy bank or on a mossy tree-trunk. Young birds dark brown, spotted lighter.

Grey-crested Flycatcher *(Culicicapa ceylonensis)*. Nests usually concealed among long moss on an old tree-trunk.

NEITNER'S Robin Flycatcher *(Hyperythra neitneri)*. A North-east Monsoon visitor. Does not breed in Ceylon.

Grey Titmouse *(Parus atriceps)*. Nests in holes in trees, buildings, etc.

Yellow-eared Bulbul *(Kelaartia penicilata)*. Nests similarly to the Common Bulbul but selects higher trees and conceals its nest better.

Nuwara Eliya Blackbird *(Turdus kinnisi)*. Seldom found below 5,000 feet, but could probably be induced to descend on to estates if encouraged. Builds a large but neat nest in close-foliaged trees as a rule.

The Indian Woodchat *(Larvivora brunnea)*. A North-east Monsoon visitor. Does not breed in Ceylon. Very shy, loving close tangled thickets, but very inquisitive.

Grey and Yellow Wagtail *(Motacilla melanope)*. A North-east Monsoon visitor. Does not breed here. Loves jungle-streams, etc.

Tree-warblers *(Phylloscopus spp.)* North-east Monsoon visitors. Quietly coloured, but graceful, active little birds which hop about the branches in a constant search for insects.

The above list gives the names of a few of the useful birds that would be attracted by such measures as are indicated above, but it by no means exhausts the list of beautiful and beneficial birds whose acquaintance is worth cultivating for their pest-destroying propensities.

G. M. HENRY.

ECONOMIC SUCCULENTS.

The object of these notes is to bring forward the economic value of a type of plant but little grown in this part of the East, chiefly because of its humid conditions, but which nevertheless comprise a considerable number of economic importance, as well as many showy-flowered and peculiarly-constructed plants.

Natives of the dry regions, succulent plants are so constructed as to thrive where the amount of water obtainable would be deficient for non-succulent plants. They are as a rule characterised by the possession of some special structure or adaptation for the purpose of maintaining a balance between the water absorbed by the roots on the one hand and that transpired or exhaled by ærial surfaces on the other.

They maintain this balance most conspicuously by the storage of water within specialised structures, thus explaining the term Succulents by which they are generally known. The latter also have a special epidermal or skin structure which ensures the leaf, or that portion analogous to it, performing its functions with a minimum loss of water; and often, the shapes assumed by the plant are such as to expose the smallest area of external surface to the air.

Such plants are grown best wherever dry conditions are liable to prevail for any length of time; but despite this fact, they are not always averse to water, and are indeed, in many cases, given to absorbing considerable quantities, but only during their growing periods. Of the economic succulents the chief are the Agave, Furcræa, Aloe and Opuntia.

The Sisal hemp (*Agave rigida* var. *sisalana*) is probably the most important of this group, producing a very valuable fibre which is exported in considerable quantities from Mexico to the markets of America and England, where it enters into keen competition with Manila hemp. It is now cultivated in many parts of the tropics, chiefly in South America and East Africa. The Agaves prefer dry conditions, but can be cultivated in a wet climate provided good drainage is assured. The American Aloe (*Agave americana*) is of less economic value than the above, but is highly valued in Mexico, its native habitat. Its large fleshy leaves which yield a strong coarse fibre are used for cordage and brushes, while the sap which exudes in large quantities from the base of the flower spike when cut is fermented into an intoxicating liquor called "Pulque" and is consumed in large quantities by the people; but if taken in excess, acts as drug. This, and other species of Agave are used in times of drought as cattle fodder, the sharp points and edges being removed, and the remainder cut up into small pieces before use. *Agave tequilana* WEBER, a quite recent introduction to Peradeniya from Kew should prove a useful acquisition to the economic Agaves, this being of special interest in the fact that it is reported to be used both as a source of alcohol (known as Mezcal) and as a source of fibre. The chief value, however, is the fibre which is said to rival in quality that of *Agave rigida* var, *sisalana*. This species is a native of Mexico and is easily cultivated, but it prefers dry conditions. The Agaves are adapted for forming hedges, making an efficient and formidable barrier.

The Mauritius hemp (*Furcræa gigantea*), a native of tropical America and naturalised in parts of Ceylon and India, is another source of fibre, being used principally for making cordage, etc. These need conditions similar to the Agaves, but grow better at a higher elevation than the latter, and though no commercial use is made of the fibre in Ceylon, it is produced on a large scale in Mauritius. The leaves of Furcræa when growing in a wild state have spines along the margin of the leaves, but the cultivated form is practically spineless.

Another genus of economic interest is the Aloe, a native chiefly of South Africa. "Aloin" a purgative principle, is obtained from the thick fleshy leaves of *Aloe vera* and the natives of South Africa are perfectly aware of this, fashioning home made pills for their consumption. It is obtained by cutting the leaves transversely and allowing the fluid to exude into a vessel after which it is evaporated to a proper consistency by artificial heat. Of the dwarf growing kinds, *Aloe vera*, *A. spicata* and *A. africana* are the principal commercial species, the latter being found wild in Northern Africa, and long cultivated in the W. Indies. Of the taller woody kinds, *Aloe Bainesii* and *A. dichotoma* are the chief species, the latter attaining a height of 20 ft. and called the "Quiver tree."

The Indian Fig (*Opuntia ficus-indica*) is a native of Mexico, and has long been naturalised in Southern Europe. The genus is usually recognised by its flat-jointed stems, and tufts of spines. The fruits of some species are much relished by the natives of New Mexico and Arizona. *Opuntia* (*Nepalea*) *coccinellifera* was formerly used extensively for the support of the Cochineal insect (*Coccus cacti*), a parasite peculiar to this species. *Opuntia Dellinii*, the "Prickly Pear" of S. America, the fruits of which are edible, has now become one of the worst of pests, notably in parts of Australia. The succulent branches, however, are useful as cattle food in times of scarcity, the method of preparing this being to singe the branches over a stove fire to destroy the spines, and mix with 6 per cent. of its weight of cotton seed. Where this plant has become a pest, the usual method adopted to eradicate it is to inject arsenite of soda into the base of the stems.

T. H. PARSONS.

THE IMPORTANCE OF GOOD SEED.

The suspension of field operations will provide an opportunity for looking closely into the question of the seed supply. Prominence has been given lately to the labour problem and the supply of manures, but little has been said about seed. Efficient labour and the use of suitable fertilizers will avail only so far as they are supported by a wise selection of seed. Unless this be pure, robust, and fertile it does not matter much how much money is spent in labour and manures.

In the February JOURNAL OF THE BOARD OF AGRICULTURE PROFESSOR BIFFEN, of Cambridge, gives the results of a three years' inquiry into grass, clover and mangold seed, but the principles apply to all kinds of seeds. The verdict on 676 samples examined was that "though seeds of the highest quality can be purchased, much of the seed offered for sale is of indifferent quality, while some of it is excessively bad." If the facts presented are typical, there is no need to look beyond the seed supply for an explanation of the poor returns yielded by large areas of both arable and grass land, and judging from the facts disclosed by PROFESSOR BIFFEN the supply of cheap seed is unlikely to diminish so long as farmers put price before merit.

The great defect of the seed trade is the method of distribution. Seed is sold in every market town in the country by tradesmen who have no special knowledge of the business and who probably know little concerning the origin or character of the seed they retail. The growing, harvesting, and dressing of seed are skilled operations of the first importance; but if the buyer is to avail himself of the advantages offered by the exercise of such skill, he must procure his seed from trustworthy sources and have some sort of guarantee that the article is of the quality represented. The question of price should hold a secondary position. Guaranteed seeds of high germination are the best investment of the kind that farmers can make. MR. BIFFEN tells of a sample of red clover seed which had so low a percentage of real value that a seed-rate amounting to over a ton per acre would have been necessary to secure sufficient clover seeds to provide a full plant—2,240 lb., as compared with the normal 10 lb. to 20 lb.

Deficiency in yield is not the only consequence of indifference as to the character of the seed sown. Foreign admixtures are not always harmless; weed seeds are often plentiful, and by introducing the seeds of docks, plantains, and such like—not to mention the parasitical dodder and other pests in imported seeds—the farmer nullifies the results of his weeding operations as effectively as he discounts the advantages of efficient tillage and judicious manuring by sowing seed of poor quality.

BRITISH SEEDS FOR INDIA.

A representative of MESSRS. SUTTON, of Reading, stated that the firm was about to open a large seed depôt in Calcutta, which will act as a centre for the distribution of seeds to every part of India. Hitherto the greater part of the seeds used there has been supplied by German seedsmen. Among the seeds which MESSRS. SUTTON intend specially to cultivate are those of asters and stocks, of which Germany had the monopoly. South America, the firm's representative added, had also been a fine field for the operations of the German seed-growers, but he did not think the German trade there, which had dwindled since the war commenced, would have much chance of reviving after peace was restored.—THE TIMES.

THE CULTIVATION OF GROUND-NUTS.

J. STEWART J. McCALL.

Any soil that can be kept in a friable condition is suitable for ground-nuts if it contains sufficient lime and humus; the highest percentage of marketable nuts are produced in sandy loams; soils deficient in lime if rich in nitrogen will produce luxuriant vines but little fruit, and clay soils are always unsuitable, producing small pods of low quality.

CULTIVATION.

In ordinary field conditions the soil should not be cultivated to a greater depth than 6 inches but it is essential that the tilth is thorough; deep cultivation adds considerably to the cost of harvesting.

If the soil is carefully selected, little after-cultivation is necessary; three hoeings before the crop covers the ground are generally sufficient.

It is also important to have the plants so close as to completely cover the ground when full grown and protect the soil and roots from direct sun; 15 in. × 15 in. is a suitable distance.

Flooding is detrimental to the crop but it requires bright sunshine and large quantities of water at frequent intervals and gives excellent results in Egypt under well controlled irrigation.

MANURING.

The high percentage of nitrogen and phosphoric acid contained in ground-nuts makes it an exhaustive crop even although the nitrogen is largely collected from the atmosphere, and the crop therefore responds freely to liming and manuring although in Nyasaland it is generally raised without manure.

Care must be taken to see that sufficient lime is present in the soil before applying heavy dressings of farmyard manure, otherwise the crop may become too luxuriant to produce flowers freely and result in a diminished instead of an increased yield.

PLANTING.

Ground-nuts take from six to seven months to mature and should be planted in December or January: early planting is recommended.

The quantity of shelled seed required per acre depends on the system of planting, but thirty to thirty-five pounds per acre is ample with a planting distance of 15 in. × 15 in.

HARVESTING.

This is by far the most expensive operation and no system yet devised can do away with a large amount of labour for gathering the crop. In Nyasaland it is dug and gathered in a manner very similar to the Irish potato crop.

White ants greatly increase the cost of this operation by eating away the dead and drying vines and leaving the earth-nuts more or less isolated in the soil, thus necessitating an increased amount of gathering.

The nuts themselves are seldom devoured by this pest although the withered pod is frequently attacked; in fact, during the growing season the crop is specially free from insect attack but suffers to some extent from rust fungus.

After harvesting expose the nuts to the sun for a week or more until perfectly dry, and do not shell until required for shipment as they keep better in an unshelled condition.

In the experiments at Namiwawa Government Farm it was found that the average percentage of exportable kernels was only 55 per cent. of the weight of the unshelled nuts, and at least 5 per cent. would be accounted for by the depredation of harvesters and shellers.

The yield of ground-nuts per acre varies greatly and in our experimental planting of the last six years, on several soils at various elevations, it has ranged between 200 pounds and 1,532 pounds per acre.

Under ordinary field conditions four acres to the ton of shelled nuts would be an average for Nyasaland and the following figures taken from a 6½ acre block grown at Namiwawa on unmanured land in 1915 show the cost of production and value of the crop, the figures being based on actual working expenses.

Cost of production per acre and value of crop.

	s.	d.
One ploughing	2	8
One cultivation	0	8
One harrowing	0	4
Three hand hoeings @ 7½*d*.	1	10½
Harvesting and shelling	12	8
...	18	2½

The total crop from six and a half acres was 7,318 lb. of unshelled nuts which on shelling gave 4,024 lb. of sound shelled nuts or a yield of 619

pounds of exportable kernels per acre and at £13 10*s.** per ton represents a value per acre of £3 14*s.* 6*d.*

The present freight on ground-nuts from Port Herald to England is £5 8*s.* 5*d.* per ton (as against a pre war rate of £3 per ton) and after deducting the freight charges at 30 30-per acre and allowing 3*s.* 9*d.* or 5 % of sale price for brokerage, etc., and ten shillings for sacks the nett cash profit is only 12*s.* 6*d.* per acre which, under present freight conditions, does not compare favourably with cotton and tobacco and prohibits the profitable cultivation of this crop for export by Europeans north of Port Herald.

Any appreciable increase in the export of ground-nuts from Nyasaland is more likely to arise by fostering native cultivation in garden plots and encouraging the growers to sell their crops to European Traders at ½*d.* per pound; under such conditions a native cultivator should be able to realise from 25*s.* to 30*s.* per acre, which is good return for his own labour, and the exporter from £1 10*s.* to £3 per ton depending on market prices.

During the last few years there has been an annual export of one hundred to one hundred and fifty tons of nuts grown principally by the natives in the Lower Shire District but the trade is largely in the hands of Banyans who purchase by barter acting as the middleman between the native grower and the European exporter.

In conclusion it might be pointed out that the crop, being less sensitive to climatic variations than cotton and much freer from disease, is worthy of the attention of the larger Land Companies who could, if interested, encourage their tenants by distributing selected seed and guaranteeing to purchase the crop at one half penny per pound after deducting the weight of the seed issued.—SUPPLEMENT TO THE NYASALAND GOVT. GAZ. NO. 4 OF 1915.

COMMITTEE OF AGRICULTURAL EXPERIMENTS.

Minutes of a meeting of the Committee of Agricultural Experiments held at the new class-room of the School of Tropical Agriculture, Peradeniya, on May 11, 1916.

Present:—The Director of Agriculture (Chairman): the Hon. the Rural Member of the Legislative Council; the Chairman, Ceylon Planters' Association; the Botanist and Mycologist; the acting Entomologist; the Assistant Botanist and Mycologist; the Rubber Research Chemist; the Superintendent, Botanic Gardens; Mr E. R. SPEYER, Special Entomologist; MESSRS. R. G. COOMBE, J. S. PATTERSON, G. H. GOLLEDGE, J. B. COLES, A. W. BEVEN, Mudaliyar A. S. DE E. RAJAPAKSE, Lt.-Col. W. G. B. DICKSON, MESSRS. N. G. CAMPBELL, G. H. MASEFIELD, T. Y. WRIGHT, H. D. GARRICK, A. S. LONG-PRICE, E. W. KEITH, and the Secretary; and as visitors MESSRS. H. L. DE MEL, P. R. SHAND, A. J. AUSTIN DICKSON, ALLEN B. THOMPSON, R. F. MARSDEN, H. WILKINSON, J. A. M. BOND.

SHOT-HOLE BORER REGULATIONS.

1. The Chairman in referring to the minutes of the last meeting explained the steps he had taken with regard to the proposed redrafting of the Shot-hole Borer Regulations.

MR. COLES was of the opinion that the Ordinance as amended by their suggestions would work more satisfactorily than the way suggested by the Chairman.

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* Note.—Average price on home market, 1914.

MR. COOMBE understood that under the existing Ordinance it appeared difficult to prosecute sellers of plants from nurseries infected with Borer.

MR. T. Y. WRIGHT said that an advertisement for the sale of such plants had lately appeared in the papers and that such cases were of frequent occurrence and were apparently being sold with impunity.

MR. COLES said that in his opinion a district and not a single estate should be proclaimed.

MR. HUYSHE ELIOT said that such a measure would practically prohibit the sale of tea plants over the whole Island.

MR. GOLLEDGE wished to know if this Ordinance should be made to apply to other tea pests, such as Tortrix, as well?

The Chairman thought that at present it should apply to Shot-hole Borer only.

MR. MASEFIELD thought that it would be more satisfactory if the re-draft of the Ordinance could be circulated amongst members who could then study it at their leisure and make their comments on it at next meeting.

The Chairman said this should be done. The Chairman then invited MESSRS. COLES and LONG-PRICE to meet him at 9 a.m. on May 20th to consider the re-draft.

GERMINATION OF COCOA SEEDS.

2. Turning to the Progress Reports the Chairman drew attention to the report received from the Department of Agriculture, Federated Malay States, on the germination of cocoa seed that had been sent by the Ceylon Agricultural Society. Some of the pods, he said, were packed in charcoal, and after a month's transit 87 per cent. of the seeds germinated. Some pods were dipped in alcohol, corrosive sublimate and paraffin and the germination of these, after a month, was nil. Seeds were extracted from pods and packed in charcoal and after 3 weeks 28 per cent. germinated.

MR. H. F. MACMILLAN said he found the system of packing the pods in open crates very good for short distances.

MR. E. W. KEITH confirmed this. He said for long distances he preferred packing the pods in dry charcoal.

It was suggested that spraying with carbolic acid, corrosive sublimate or alcohol and then packing pods in charcoal would probably make them last longer.

CLAYING OF BLACK COCOA.

3. With reference to the claying of black cocoa, it was pointed out that this resulted in an appreciation in price of Rs. 9/50 per cwt. at a cost of 60 cents per cwt.

MR. E. W. KEITH said this corresponded with his experience of the London Market.

MANURING OF COCONUTS.

4. MR. A. W. BEVEN inquired why such a long interval as three months was allowed to elaspe in the application of lime to coconuts and the subsequent application of manures.

MR. L. E. CAMPBELL pointed out that this interval was not too long. It might perhaps be extended if weather conditions were not favourable to the speedy neutralisation of the lime to safeguard the manures against the loss of ammonia.

GERMINATION OF COCONUTS.

5. Turning to the Report of the Anuradhapura Experiment Station the Chairman drew attention to the germination of coconuts in the nursery there which was at the rate of 93 per cent.

MR. A. S. LONG-PRICE stated that he thought a germination of 90 per cent. should always be maintained.

SETTING NUTS IN NURSERY.

6. On the question as to the position in which nuts are set down in the nursery the Chairman stated that the Department of Agriculture always planted their nuts by placing them on their sides.

MESSRS. A. W. BEVEN, A. S. LONG-PRICE, G. H. MASEFIELD and H. L. DE MEL said that this was in accordance with their practice also.

MR. A. E. RAJAPAKSE said that he planted his seed nuts upright in the nursery.

TEA AND COCOA IN THE DRY ZONE.

7. It was decided to put a small plot under tea at the Anuradhapura Experiment Station to see what the result of cultivation of tea under irrigation in the dry zone would be.

MR. MASEFIELD suggested that some information might be obtained from India on the question whether tea had been successfully grown under irrigation.

A proposal to set out a cocoa plot at the Anuradhapura Station was also approved.

NEGOMBO COCONUT TRIAL GROUND.

8. MR. A. E. RAJAPAKSE submitted a report on the Negombo Coconut Trial Ground for the last six months ending the 31st December, 1915.

This is an experiment on the up-bringing of young coconuts on poor, sandy soil.

The report for the year will be ready after the end of June.

ENTOMOLOGIST FOR TORTRIX.

9. MR. COLES asked how long the Committee had been considering the question of Tea Tortrix and with what result.

The Chairman replied that the Committee began considering the question on May 13, 1915 and the result was that Government had sanctioned a special Entomologist temporarily to investigate Tea Tortrix. This announcement was received with much satisfaction.

The Chairman in reply to enquires stated that he had written to MR. MAXWELL LEFROY to know if he could suggest a man. Other people had also been written to.

THINNING OUT OF RUBBER.

10. MR. J. S. PATTERSON submitted some figures showing the result of thinning out rubber on a plantation 20 years old, as follows :—

15 ACRES OLD RUBBER.

Season	Crop	Yield per acre	Trees	Trees per acre	Rainfall
1907/08	4003	267	2419	161	145·41
08/09	4020	268	2419	161	168·49
09/10	5146	343	2419	161	137·65
10/11	6594	439	2419	161	142·64
11/12	6425	428	2419	161	167·02
12/13	6532	435	2419	161	161·41
13/14	6001	400	2180	145	196·84
14/15	6596	439	1604	106	134·97

These figures showed that profitable results appeared to follow the thinning out of a plantation even of this age. He wished to know the opinion of the Committee, especially of the authorities at Peradeniya, whether it would be more profitable to begin thinning out at an early date or leave it till the plantation was, say, 20 years old and then thin out.

Several members of the Committee offered remarks, including MESSRS. G. H. GOLLEDGE, G. H. MASEFIELD, the Hon'ble MR. R. HUYSHE ELIOT, MESSRS. T. PETCH, CAMPBELL and MARSDEN. It was generally agreed that there was no data for laying down definite conclusions on this subject. It depended upon so many factors—the original spacing, climate and price of rubber. It was nevertheless agreed that thinning out should not be delayed too long, but should be done early enough to allow the trees ample opportunity to branch.

CARBOLINIUM.

11. MR. KEITH said that he understood that as Carbolineum for bark renewal was of German make, a substitute called Brunolinum was now on the market. Could anyone give an opinion on this substance.?

MR. PETCH replied that the Carbolineum Plantarium recommended previously was made in Holland. The German Carbolineum sold in Colombo was for use against white ants. The substitute now on the market would be tested as soon as possible.

VISITATION OF LOCUSTS.

12. MR. T. Y. WRIGHT brought up the question of locusts which had made their appearance in the Matale District and wished to draw the attention of the Department of Agriculture to the matter.

MR. H. D. GARRICK stated that his experience of these locusts extended over many years. They attacked dadap freely but had persistently refused to attack tea, rubber or cocoa. He thought he had noticed this year a plantation of tea covered with locusts but could not say whether they caused any damage to the tea.

It was decided that the Department of Agriculture should invite the Ceylon Planters' Association to collect data as to the localities in which the swarms had occurred, the specimens to be sent for identification, and investigations to be made to see whether they are likely to become dangerous, especially in tea.

CASTILLOA RUBBER.

13. The Chairman said there were two small plots of Castilloa rubber on the Experiment Station occupying space which could be more usefully planted with other products. Had any member any objection to the trees being cut out? A few specimen trees would be left. No objection was raised.

NODULES IN HEVEA.

14. MR. PETCH inquired whether any member could inform him of any area of untapped Hevea trees not less than five years old, as it was desired to ascertain the prevalence of nodules on untapped trees. The trees would not be damaged in any way.

MESSRS. R. G. COOMBE, PATTERSON and MASEFIELD promised to place such areas at MR. PETCH'S disposal.

WATER HYACINTH.

15. The Chairman drew attention to the specimen on exhibition of Water Hyacinth—a proscribed pest which choked up water-ways.

MR. BEVEN said he believed that a use as a green manure had been found for this pest.

DUDLEY S. CORLETT,
Secretary, Committee of Agricultural Experiments.

LORD WILLINGDON ON INDIAN AGRICULTURE.

(Address to Students of Poona College.)

I feel a particular pleasure in coming to talk to you agricultural students, for you are studying here to make yourselves efficient in a profession in which I have been interested for the past 25 years, an industry on which in this as in most other countries of the world the livelihood and welfare of the great majority of the population largely depends, and you can therefore readily understand how important Government considers it to be to provide young men here with a thorough instruction in the science of agriculture in order that they may apply the results of their knowledge for the benefit of their country in future years. I would add that you are studying for a profession of which you may well be proud, and that if you seriously mean to give your lives to spreading in the districts in which you live the experience and teaching you have received here you will be doing a great work in promoting the welfare of many of your fellow citizens.

Let me admit that when I first came to India with some experience of farming in England, I thought I was going to show you all how land should be farmed here so as to attain the best possible results, but after 2½ years' life in this country I have come to the conclusion that we have little to teach the Indian farmer as to the main principles of his occupation, for he has the experience of many generations behind him; and therefore to-day I am going to tell you nothing new but merely give you some impressions as to how our best efforts should be employed in helping the agriculturist to improve his farming by using all the best methods so as to get the best results from the soil.

TRAINING OF AGRICULTURISTS.

Before, however, I discuss that matter I want first to express my opinion that the general principles employed in the education of young men to a knowledge of agriculture are very much alike in India and my own country. In England as in India we have agricultural colleges such as this where young men come to be instructed in order that they may fit themselves either to cultivate their own land or become land agents to large land owners or go into Government service. And in England as in India these young men cannot all go into Government service but many live healthy independent lives and make good profits as farmers in various parts of the country.

But there are points of dissimilarity in the main principles of farming in the two countries to which I should like to draw your attention.

In the first place in England the land is owned entirely by individual landlords; in India, and I am now talking about British India, while I admit there are exceptions, the supreme landlord and owner is generally the Government. In the second place the English landlord is in very many cases a farmer himself, and has a home farm where he cultivates his own crops and breeds his own cattle; in India, while I am aware that many instances can be found where the landlord takes an active interest in the agricultural development of his property, there are too many cases where the great landowner is merely a rent receiver and knows little of a practical nature of this great industry from which most of his income is derived. Speaking from personal experience I can affirm that there is nothing which gives a landowner so intimate a knowledge of the difficulties a farmer has to contend with, nothing which brings him into closer touch and sympathy with his tenants than the experience of being a practical farmer himself;

further than that there is nothing which tends to improve the various breeds of cattle in a country than when a landlord breeds the best stock himself and from time to time sells his surplus stock and thus improves the general quality of the cattle in his district. But there is one other point of dissimilarity which I wish most particularly to impress upon your minds. The farmer in England is in most cases an independent man with independent means who makes his living out of his farm and can bring up and educate his children to such professions as they are best fitted. The small yeoman and peasant farmer in India is as we all know very largely in the hands of the money-lender, and has no independence from year to year in the cultivation and sale of his crops. I want to see the farmer class in this country an independent self-reliant people, free to use and cultivate their land to their best interest and advantage. Government is doing what it can by encouraging the co-operative system throughout the country, and I hope that you young men will make a point of getting a thorough knowledge of its principles in order that you may all help us to promote a scheme which will in time if carefully managed relieve the farmer from his heavy burden of debt.

TEACHING THE FARMER.

I said just now that I had come to the conclusion that we could not teach the farmer much in the matter of what he was to grow, but that we could help him by showing him the many improved methods which would add to the productivity of the soil.

What, let me ask, are the chief requirements for the production of a satisfactory crop? 1. Knowledge of the quality of the land you are farming and the best rotation of crop to procure the best results. 2. A sufficient supply of water by rainfall or by artificial means. 3. Good and careful cultivation, specially remembering to keep the land clean and free from weeds. 4. The most efficient implements for ploughing, sowing and harrowing the land. 5. The most suitable manures to put on the land in order to keep up its vitality. 6. The necessity to use the best and not to be satisfied with inferior mixed seeds. If we could secure all these conditions, it is difficult to estimate how immense would be the increase in the output from the soil, and in consequence how great the benefit to our agricultural population Much has been and is being done by irrigation, well-boring and pumping to increase the certainty of water; much too has been effected by the establishment of experimental farms, and by practical demonstrations to encourage the agriculturists to improve the produce he grows, and it is very gratifying to find that in many parts he is readily adopting more progressive methods and taking full advantage of such improvements as are within his means to increase the produce from this land.

But while as I say much advance can be claimed on the crop raising side of agriculture, it must be admitted that little advance has yet been made in the important question of stock raising in this country. It is impossible for me to deal with it in any great detail to-day, but I would like to give you a few ideas and impressions which may be worth your consideration in the future on this most interesting branch of agricultural life. Let me first lay down a general proposition, which I think will receive general agreement, that it is economically better, whatever the stock is that you wish to raise, whether it is cattle, or horses, or pigs or sheep or poultry, to secure and to breed the best you possibly can; they will cost little more and they will give you far better results.

CATTLE BREEDING.

I think it will also be agreed that on the whole, though I am glad to know that there are exceptions, the breeding of stock, particularly of cattle, is in this country of a most promiscuous and unsatisfactory character. I

have already given you in an early part of this address one suggestion which I think an essential one in the improvement of cattle breeding, *viz.*, that big landowners should breed good cattle and take a really practical interest in farming. Let me give you another suggestion which I think is essential to raising good stock. In England we have several distinct breeds of pure bred cattle, which originally started by certain individuals establishing herds of each breed which were called Foundation Stock herds. The progeny of these Foundation Stock animals were registered year by year, the surplus stock sold, and from these beginnings I think we can fairly say that England produces year by year some of the best cattle in the world. I am of opinion that this is the system which we should start here. There are several distinct breeds of cattle in this country which already have a ready sale at home and abroad. If we take our Presidency alone we find them in Kathiawar, in Sind, in Gujarat, and in other parts; and I am given to understand that the sale to foreign countries of our best Karachi cattle has been such of late years that there is serious danger of the breed dying out. Government, I assure you, will do what it can, but we shall want the co-operation of big landowners and farmers to start such Foundation herds, and thus gradually improve the general quality of cattle throughout the Presidency.

IMPROVING OUR STOCK.

It is of course very true that while I believe the plan I have sketched out is the main essential for improving our stock, there are other matters of detail which must be carefully attended to if we hope to achieve success in our breeding. The careful management and feeding and exercising of the stock, particularly with regard to the raising of the young animals, the conservation of fodder and the use of ensilage so as to provide against times of scarcity, the use of the farmyard manures on the land, the early castration of young bulls if they are not wanted for stock purposes,—these and other matters are essential to success. But I am convinced of this, that with a combined effort on the part of landowners, farmers and the Government, much can and should be done to improve the quality of our cattle, to encourage an interest in careful breeding and selection and to secure in years to come typical Indian herds producing stock which for draught and for milk producing purposes will bear comparison with some of the best cattle in other countries of the world.

PIONEERS OF HIGHER FARMING.

I have given you this outline of some of my views on this great industry for a very particular purpose. You young men who come to this college and go out of it I hope fully equipped with practical knowledge are in real truth the pioneers of higher farming in this country. Some of you may come into Government employ, others may go as land agents to big owners, others of you may occupy yourself in your own homes on your own land. I beg you to realize the great responsibility that lies before you and to remember that in these days of keen competition it is practical knowledge of and efficiency in the conduct of any industry that will give you the best results in the markets of the world. It is for you by your experience and teaching here to set the example of the best methods of agriculture wherever you are, that those who live round you may follow that example and in time make them follow that example in a profitable and satisfactory business. Your task if you do it properly is a great one, for it means the raising of the condition of the farming population so that they will become an independent and self-respecting class. To each and all of you I wish God-speed in your work and trust that your experience gained here may be of the greatest value to your lives in the future.—AGRICULTURAL AND CO-OPERATIVE GAZETTE OF NAGPUR.

PROGRESS REPORT OF THE EXPERIMENT STATION, MAHAILUPPALAMA.

(From 15th February to 15th April, 1916.)

COCONUTS.

The first picking was done in March, 1916. The number of nuts collected was 1,781 from 443 palms, an average of 4·02 nuts per bearing tree or 1·06 per acre tree.

Of this quantity, in the irrigable area (8 year old trees) consisting of 1,224 trees, 303 trees gave 1,637 nuts, an average of 5·56 per tree or 1·33 per acre tree.

In the unirrigable area (9 year old trees) consisting of 449 trees, 28 trees gave 144 nuts, an average of 5·14 nuts per tree or ·32 per acre tree.

The block of sickly palms in Plot C growing in a poor patch of soil were manured with 2 lb. guano per tree in May, 1915, 10 lb. per tree of cotton seed in November, 1915, and 5 lb. per tree in February, 1916.

The following figures have been obtained with regard to Copra production :—

COMBINED PLOTS.

Month.	*Break nuts.*	*Rejections.*	*Copra produced.*		*No. of nuts per candy.*
January	1,472	—	588 lb.	...	1,401
			Plot A.		
January	1,264	—	510 lb.	...	1,387
			Plot B.		
January	208	—	78 lb.	...	1,493

A consignment of Copra was sent to Colombo and sold on 26th February, 1916, fetching Rs. 74·50 per candy.

It has been decided that as the plots are now yielding such large quantities of nuts, only an average of 200 nuts per plot will be taken for weighing purposes and the copra from these will be turned into oil which with the poonac will be weighed separately. From this the average yield per acre can be calculated. The remaining nuts from each plot will be counted and then turned into copra and sold in Colombo.

The oil has been sold in Anuradhapura for Rs. 2·12 and Rs. 2·25 per gallon.

A nursery of 500 selected nuts has been laid down.

The ploughing and disc-harrowing of the plots has been continued.

DUDLEY S. CORLETT,
Acting Manager, Experiment Station, Mahailuppalama.

PROGRESS REPORT OF THE DRY ZONE EXPERIMENT STATION, ANURADHAPURA.

(From 15th February, 1916, to 15th April, 1916.)

TOBACCO.

1. A tobacco air-curing shed of cadjans has been erected on the plots.
2. White Burley was harvested on April 4th and was a good crop. The Dumbara, Zimmars, Spanish and also fine crops were harvested 10 days later.

CEREALS.

3. The dura has been harvested and yielded a good crop. The seed has been stored at Peradeniya in air-tight bins for distribution in May to districts served by the North-East Monsoon.

Plots have been re-sown under irrigation and are looking remarkably vigorous.

Maize does not do well even under irrigation; it is essentially a sub-tropical plant.

COTTON.

5. The Cambodia cotton plot is making a fine show of bolls though a certain number has fallen in consequence of the unusually heavy rain in March. The Sea Island and Upland Cotton have begun to open.

COCONUTS.

The nursery of 750 nuts put down has germinated very well, only 50 having failed. The plants are very vigorous and healthy.

COFFEE.

The nursery of Coffee Robusta has germinated well and will be ready for planting out in the prepared shaded plots in October.

50 plants in bamboos have been sent down from Peradeniya to be planted under the dadap shade and kept irrigated.

SUGAR.

The sugar cane is ratooning very well.

OIL PALMS.

9. The oil palms are beginning to grow rapidly and a new crop of inter-sown legumes is nearly ready to be cut and dug in. An acre plot on unirrigable land has been laid out $22\frac{1}{2}' \times 22\frac{1}{2}'$ with oil palms from the nursery.

10. The linseed sown in February on an irrigated plot has failed.

11. The ground-nuts are proving a very fine crop under irrigation and have been earthed up.

12. Russian Sun-flower has been re-sown under irrigation and promises well.

TEA.

13. A plot has been prepared for tea under irrigation and a light shade of *Sesbania grandiflora* and green manure.

COCOA.

14. Plants will be sent from Peradeniya to be established under dadap shade and irrigation.

At Mahailuppalama there are several cocoa trees growing in the old Cerea rubber plot and apparently flourishing, in spite of the fact that they have received no cultivation or water for years.

LEGUMES.

15. The climbing *Phaseolus lunatus* bean continues to bear very heavy crops under irrigation.

16. Two varieties of cluster bean have been re-sown for green-manure amongst the fruit plots, where they are making luxuriant growth with irrigation.

FODDERS.

17. The Teff grass has grown well and been cut once for the cattle, and is now making a vigorous ground growth.

18. A plot of Teosinte has been sown.

STARCHES.

19. The cassava plots are looking extremely well and vigorous of growth.

20. Sweet potatoes have done very poorly.

21. Arrowroot has made a very fine growth and promises a good crop.

SPICES.

22. Turmeric is a complete failure.

23. Betel vines make poor growth.

FRUITS.

24. Three Egyptian date palms grown from seed at Peradeniya have been planted in the high lands. Plants from the Stock Garden will also be planted.

25. Melons have made very good growth and attained a large size. The unusually heavy rains in March have again caused them to burst before attaining full ripeness.

26. Pineapples are fruiting well.

27. Guavas are bearing fine large clusters of fruit.

28. The plantains show very fine growth under treatment of green, manure and irrigation. Six suckers each of selected varieties of Red Banana-Kolikuttu, Ash plantain, Hondarawala, Suvandel and Anamalu have been obtained from Malkaduwa estate, Kurunegala and planted.

29. The grafted mangoes are making good growth.

30. Six mangosteen plants in bamboos raised at Peradeniya have been planted.

31. Two plots of papaws have been established.

32. The citrus trees look well after the green manure has been dug in and the new crop of leguminosæ is nearly ready to be cut and applied. Three crops of this rich, nitrogenous manure can be grown and applied annually with very little trouble, between the trees.

All the plots under irrigation are making a remarkably fine show and make a striking sight from the Jaffna road, surrounded as it is by miles of waste jungle all capable of producing like crops of prosperity and wealth.

VISITORS.

Several planters passing by have visited the Station, and a party of boys from St. Joseph's School were personally conducted round by the Manager.

DUDLEY S. CORLETT,
Acting Manager, Dry Zone Experiment Station.

PROGRESS REPORT, PERADENIYA EXPERIMENT STATION.

(From February 15th to April 15th, 1916.)

TEA.

The yield for the month of February was 1,905 lb. green leaf, a drop of nearly 1,000 lb. owing to the severe drought. That for March was 2,712 lb. from 10 acres, including 667 lb. plucked from the live-branch left on five acres of pruned tea.

2. December made tea fetched 56 cts. per lb. for Broken Orange Pekoe and an average of 48·50 cts; for January 58 cts. and an average of 50 cts.

3. Plots 146-50 *Manipuri Indigenous* were manured with 100 lb. Basic slag and 60 lb. Sulphate of Potash per acre, every alternate line forked in with the leaves and the prunings placed on the top as mulch.

4. Plots 146-150 are being tipped.

5. Plot 155 (cattle manure in 1911), Assam Hybrid, gave in March 380½ lb. or 76 lb. over the next best 304 lb. (dadap plot) 2,592 plants.

RUBBER.

6. *Tephrosia candida* on all plantations has been cut and mulched for the thirteenth time since planting in 1913.

7. Trees under rubber manuring experiments have been dressed with the following mixtures, the manures being applied in a trench dug between the rows :—

Plot 83 A B, 42 trees. General Manure.

Supplying N. 50 lb. P_2O_5 30 lb., Potash 30 lb.

Plot	84 lb.	Groundnut cake	200 lb.	Containing		
	84 ,,	Bloodmeal	200 ,,	Nitrogen	...	50 lb.
	57 ,,	Steamed bone meal	136 ,,	Phos. acid	...	30 ,,
	31 ,,	Sulphate of Potash	75 ,,	Potash	...	30 ,,
	26 ,,	Sulphate of Ammonia	60 ,,			
			671 ,, per acre			

or 6·71 lb. per tree.

42 trees × 6·71 lb.=282 lb. manure.

Plots 83 D. 84 A. 46 trees. Excess of Nitrogen.

Supplying 80 lb. Nitrogen.

Plot	84 lb.	Groundnut cake	182 lb.	Containing		
	19 ,,	Steamed bone meal	43	Nitrogen	...	80 lb.
	138 ,,	Bloodmeal	300 ,,	Phos. acid	...	9·5 ,,
	69 ,,	Sulphate of Ammonia	150			
	310		675 ,, per acre			

or 6·75 lb. per tree.

46 trees × 6·75 lb.=310 lb. per plot.

Plots 84 C. & D. 46 trees. Excess of Phosphoric acid.

Supplying 80 lb. Phosphoric acid.

Plot	20 lb.	Groundnut cake	50 lb.	Containing		
	78 ,,	Steamed Bone dust	200 ,,	Nitrogen	...	9·5 lb.
	78 ,,	Basic slag	200 ,,	Phos. acid	...	80 ,,
	176 ,,		450 ,, per acre			

or 4·5 lb. per tree containing 9·8 lb. Phos. acid.

39 trees × 4·5 lbs. = 176 lb. per plot.

Plots 85 D. 86 A. 48 trees. Excess of Potash.

				Containing		
Plot	65 lb.	Groundnut cake	136 lb.	Nitrogen	...	9·5 lb.
	96 ,,	Sulphate of Potash	200 ,,	K_2O	...	80 ,,
	161		336 ,, per acre			

or 3·36 lb. per tree containing 0·8 lb. Potash
48 trees × 3·36 lb. = 161 lb. per plot

Plots 86 B & C. 47 trees. Mineral Mixture.

Plot 131 lb.	Nitrolim	278 lb.	Containing	50 lb. N.
83 ,,	Basic slag	176 ,,	,,	50 ,, P_2O_5
35 ,,	Sulph. Potash	75 ,,	,,	30 ,, K_2O
249		529 ,, per acre		

or 5·29 lb. per tree.
47 trees at 5·29 lb. = 249 lb. per plot.

SUMMARY OF CONSTITUENTS REQUIRED.

Plots	*83 AB.*	*83D. 84A.*	*84 CD.*	*85D. 86A.*	*86 BC.*	*Total.*
	lb.	lb.	lb.	lb.	lb.	lb.
Groundnut cake ...	84	84	20	65	—	255
Blood Meal ...	84	138	—	—	—	222
Steamed Bone Meal ...	57	19	78	—	—	154
Sulphate of Potash ...	31	—	—	96	35	165
Sulphate of Ammonia ...	26	69	—	—	—	95
Basic slag ...	—	—	78	—	83	161
Nitrolim ...	—	—	—	—	131	131
						1,181

8. The two acre plot (73-76) planted in avenues 40 × 15 × 15 in June 1913 has been limed and manured after the following scheme :—

The first three double rows after the control to be limed at the rate of 8 cwt. per acre and then manured.

The end double row near the road to be kept as control.

The other three double rows to be manured without liming.

Plot 1 Lime at 896 lb. per acre.
1 Manure Mixture—Phosphoric and Potash without nitrogen
2 ,, ,, —Nitrogen and Potash ,, Phos. acid
3 ,, ,, —Nitrogen and Phos. acid ,, Potash
4 Control, cut treated with 896 lb. lime.
5 Manure Mixture as No. 1
6 ,, ,, ,, ,, 2
7 ,, ,, ,, ,, 3

Nos. 1 & 5. Without Nitrogen. 50 lb. of each constituent per acre.

Plot	34·5 lb.	Ordinary Superphos.	18% ...	138 lb.	25 lb.	50 lb.
	36·50 ,,	Basic slag	17% ...	147 ,,	25 ,,	
	30·0 ,,	Sulphate of Potash	40% ...	120 ,,	50 ,,	50 ,,
	101			405 ,, per acre		

or 101 lb. per plot.

Nos. 2 & 6. Without Phosphoric acid.

Plot	69 lb.	Nitrolim	18% ...	277 lb.	50 lb. N.
	30 ,,	Sulphate of Potash	40% ...	120 ,,	50 ,, K_2O
	99			397 ,, per acre	

or 99 lb. per plot.

Nos. 3 & 7. Without Potash.

Plot	69·0 lb.	Nitrolim	18 %	...	277 lb.	50 lb.	N.
	34·5 ,,	OrdinarySuperphos.	18 %	...	138 ,,	25 ,,	Phos. Acid
	36·5 ,,	Basic slag	17 %	..	147 ,,	25 ,,	,, ,,
	140 ,,				562 ,,	per acre	

or 140 lb. per plot.

SUMMARY OF CONSTITUENTS REQUIRED.

Plots	*1 & 6.*	*2 & 6.*	*3 & 7.*	*Total.*
Ordinary Superphos. ...	34·5	—	34·5	69 lb.
Nitrolim ...	—	69	69	138 ,,
Sulphate of Potash ...	30·0	30	—	60 ,,
Basic slag ...	36·5	—	36·5	73 ,,
				540 ,,

The lime to be applied broadcast over the three double rows and half the intervening ground and disced in.

The manures to be broadcasted between the rows of trees in a 10' strip and disced in.

A trench to be dug 18" deep and 18" wide half way between the end control plot and the first limed and manured plot.

The manures to be applied annually and the lining in alternate years.

Within a few hours of applying the lime and discing it in, an unusal (for March) and heavy rain-storm fell and much of loose surface soil and lime must have been washed away in the drains.

COCOA.

9. All the 33 acres of old plots divided in 3 A series of 11 acres each were manured in March according to the scheme previously laid down.

10. The four acres of eight-year old cocoa B divided into 16 small plots to determine the effect of correcting by lime the acidity of soil upon the influence of nitrogenous manures, were limed in January and the manures applied in March according to the scheme outlined in the report for August, 1915.

The trees in this plot have been carefully pruned.

11. The plot of LOCK's selected cocoa was limed in January, and in March an application of 245 lb. of Castor cake and 60 lb. Ammonium Sulphate per acre was applied and the whole lightly forked over.

12. The plot of 2 year old selected varieties of cocoa has had the T. candida cut and mulched for the eighth time.

13. The year old cocoa has been limed to correct acidity of soil.

SALES.

15. All the cocoa has been despatched to Colombo for sale—having been kept back in the hope of better prices. It sold for Rs. 51·50 per cwt., the highest price offered during the last six months. An experiment in claying the black cocoa with Indian red clay (Cavi) has been carried out, as black cocoa so treated commands a considerably higher price on the London markets. Whether it will do so in Colombo remains to be seen as it is not yet sold. The cocoa beans are slightly damped, the powdered clay is then rubbed on by hand; beans are then sundried and finally polished by rubbing in a sack. The final results of the cocoa yield will be published next month but it works out at something like six cwt. per acre for cocoa unmanured for four years.

A round of cutting out suckers has been completed.

COCONUTS.

16. The 10-acre plot of nine year old palms was limed in January and the manure applied in March as per scheme previously laid down.

The nuts from those plots already iin bearing are being gathered and the records kept.

COFFEE.

17. The dadap-shade over the young coffee has been lightened and mulched to the plants.

DUDLEY S. CORLETT,
Manager, Experiment Station, Peradeniya.

PAPER FROM CANE REFUSE.

Owing to the war people have been turning their attention to the manufacture of paper from megasse or bagasse as it is better known in this country. It is just possible that when shipping conditions return to normal it may pay to ship the bagasse to England or some other manufacturing centre for that purpose. Plenty of people are imbued with the idea that the manufacture of paper might be undertaken in South Africa, but the prospects seem problematical. Mealie refuse and bagasse might work up satisfactorily, but it is a subject upon which there is not sufficient information available to enable anyone to come to a definite conclusion at present.

The weekly bulletin of the Canadian Department of Trade and Commerce recently contained the following interesting details regarding the manufacture of paper from megasse, in Cuba:—

In conjunction with the making of sugar from cane at Preston, another important industry is being conducted successfully in the manufacture of wrapping paper from the by-products of sugar-cane megasse or pulp. The mill has now been in operation for a period of ten months. and in the earlier stages was only operated as an experiment. The work has started in connection with and under the direction of the Wisconsin University laboratories where the original tests and experimental work were carried on, and the plant at Preston is now in charge of the graduates of this institution.

A staff of 25 men is now employed in the mill, and four tons of paper are the daily output. The facilities and machinery at present provide only for the manufacture of several grades and weights of wrapping paper. Arrangements are now under way, and the required machinery will be added for the manufacture of all grades of paper. The pulp runs about two tons to one of paper.

The buildings are of sheet metal construction, and are built fireproof. In the main building three elevations of the floors are used in transferring the pulp to paper.

The megasse is carried from the sugar mill in cars to the paper mill, and then conveyed to the top floor of the paper factory: it is then shovelled to the floor below into "digester" tanks, where it is digested or boiled by live steam. The only difference noticeable to a layman in the manufacture of megasse paper and wood pulp paper is the process of digestion or boiling in order to soften stock to the desired point at which it can be beaten, which takes the place of grinding up the wood.

The megasse is transferred from the digesters to beators, and beaten into pulp, when chloride of lime is added to the pulp in the beaters (of which there is four), and when beaten to a sufficient consistency is dropped through

pipes to retaining tanks on the floor below. From the retaining tanks the pulp is carried to the paper mill or machine, where a quantity of water is added to it to get the thin mixture. This is run over a wire screen, and all the water is extracted by means of suction. The paper is then dried on the usual steam drums of a paper mill.

Three weights of wrapping paper are manufactured, of which the highest is 80 lb. In the case of making paper from cane bagasse the necessary grinding is done at the mill in the production of sugar, which eliminates the process of manufacture at the paper mill.

The paper obtained from cane pulp is equal to, if not slightly better than, the paper manufactured from imported kraft stock, and it can be produced and marketed at a price considerably lower than that quoted for kraft paper.

This description would seem to suggest that there is some possibility of making wrapping papers as a side industry to sugar manufacture. Anyway it is worth watching for potentialities.—THE AGRICULTURAL NEWS (Durban).

THE CHEAP FOOD POLICY.

No one disputes the benefit that England derived from her cheap food, and it is no part of our purpose to attempt to strike the balance between loss and gain. English agriculturists met the national policy of "cheap food from anywhere" by the only means in their power. In the face of falling prices they reduced their expenditure. Those who had capital laid down their poorer cornland to grass; those who had none, left it to tumble down. Theorists argue, from the experience of manufacturers, that farmers should have met falling prices by increased production. They overlook the essential difference between the two industries. In manufacture increased production means cheap production; in agriculture it does not. The law of increasing returns governs the first industry; that of decreasing returns controls the second. The soil cannot be made to increase its yield without increased expenditure, and therefore the maximum cannot be reached unless prices are remunerative. This important fact, often ignored, partially explains the present position. Farmers cannot grow more produce than they can afford.

THE FARMERS' ATTITUDE.

Those who at the present moment, for one reason or another, advocate a large immediate addition to the arable area of the country will be wise to remember three points in the farmers' position. The first is that they desire nothing so much as to be left alone. However galling may be their grievances, they prefer them to legislative interference. The second is that they know the natural protection of their industry by the rise in world prices—without any conditions as to minimum wages or Land Courts—cannot long be postponed. It must come, and come within the next few years. War may disturb, it cannot counteract, the tendency of prices to rise. The third is that they expect a heavy slump in wheat prices after the declaration of peace. When the belligerents—whether allies or enemies—have resumed their protective policy the exportable wheat surplus of the world will be sold in this country, under Free Trade, by producers who will be ready to take unremmunerative prices rather than not sell at all. With that prospect before them and their experience behind them, farmers will not plough grass for wheat unless it is made worth their while.

I am convinced that this summary correctly states the opinions of the vast majority of practical agriculturists. They are unanimous that, with the present depletion of labour, no immediate addition to the area of arable

cultivation is possible. They are equally agreed that, after the war, no addition will be attempted without that security for stable and unremunerative prices which can only be given by the natural rise in world prices, or by a change in our fiscal policy. Free Trade must either work out its own remedy for the conditions it has created, or, if special circumstances render the agricultural change an immediate national necessity, abandon its principles.

—THE TIMES.

HUMIDITY AND THE GROWTH OF CROPS.

Recent observations have made it clearer than ever that the chief climatic factor regulating the distribution and growth of crops in the West Indian islands is humidity of the air. The degree of humidity does not necessarily vary with the rainfall; the atmosphere in some parts of Grenada, for instance, contains more moisture than that in some parts of St. Vincent where the rainfall is higher. Humidity in any situation depends upon the degree of exposure, the amount of forest growth, cloud protection from the sun, and the water-holding capacity of the soil. Rainfall is the ultimate cause of humidity, but it is not the only regulating factor.

In the issue of this Journal for January 16, 1915, we published a short summary of a paper on the Gold Coast Cacao Industry, read by the Director of Agriculture of that Colony before the International Congress of Tropical Agriculture. The following extract, in its bearing upon the subject of this article, occurs to us as being well worth repetition. 'It is due to the climate, more than to the soil, that the Gold Coast is pre-eminently a cacao-growing country. The rainfall is not excessive but the humidity is high owing to the wealth of vegetation. In fact the rainfall is actually lower than in any other cacao-growing country, and a reduction in the humidity would be followed by disastrous consequences. The natives are not fully alive to the seriousness of the position, as the destruction of forest in making new clearings is being somewhat ruthlessly undertaken all over the country, and a Bill, recently introduced by the Government, for the regulation and preservation of the forests, is being vigorously opposed by the native owners of the land.'

This shows in an unmistakable manner the importance of humidity in the cultivation of cacao, and it further points to the necessity of preserving forest growth on the uncultivated areas. The protection of forest is a matter that has been given careful consideration in most of the West Indian islands. It cannot be overstated that such tree growth has a very important influence upon the atmosphere and soil seepage: but it does not increase the rainfall: it conserves the rainfall and increases the proportion of water-vapour in the atmosphere.

Limes and rubber, like cacao, require a moist atmosphere. Exactly why is a complicated question to answer, but it must be closely connected with transpiration. Further, moisture seems necessary for a proper biological balance between parasites and their natural enemies. Then, again, a moist atmosphere is generally associated with a still one, which condition is most desirable, if not necessary, for the luxuriant growth of limes and cacao.

Humidity can be artificially induced to some extent by so-called wind-breaks and overhead shade. Indeed, it is probable that the value of such protection chiefly lies in the way of maintaining a humid rather than a quiescent state of the air, though it effects both.

The degree of atmospheric humidity is determined, and most people know, by means of a wet and dry bulb thermometer. The greater the difference between the two readings, the drier the air. The relative humidity is calculated on the difference with the use of a table of factors.

This observation of humidity is of as great, if not of greater, importance than the recording of the rainfall precipitations. Very few estates, however, take the trouble to carry out the observation systematically, and scarcely any realize its full significance, which is possibly a reason for omitting the practice. Reference to the Annual Reports of the Local Agricultural Departments shows that even officially observations on humidity are not recorded in some islands, or, at least, are not published. Neglect to do so constitutes a very regrettable omission.

A valuable piece of investigation work would be the collection of humidity figures from different estates in different islands. It might lead to the solution of problems of growth at present unsolved. The trouble with limes in Montserrat, St. Kitts and Nevis has practically been reduced to a humidity basis. If attention had been given earlier to the idea, a large amount of time and trouble, and probably money would have been saved. The conduct of humidity observations under wind-break and overhead shade conditions would be productive of especially interesting results, and might settle once and for all, the conflicting statements that one hears concerning the nature of the benefit derived from this form of protection. Closely allied to foliage protection is that of cheese-cloth, under which tobacco grows more vigorously than in the open. This again is to some extent a question of humidity. It is hoped that this and the foregoing considerations will stimulate the interest of planters in what is for them a very vital question.—

The Agricultural News.

PRUNING OF GARDEN ROSES.

To many amateur gardeners the pruning of their roses is an operation shrouded in mystery and calling for expert assistance. To others—they are comparatively few and far between—it is mere child's play: but they know the roses in their gardens as a shepherd knows his flock, and in truth an intimate knowledge of the ways of individual roses is necessary before one can become adept in the art of pruning.

When the method to be followed depends on the idiosyncrasies of each member of a most variable family, no arbitrary rules can be laid down for pruning, for within the various sections into which roses are grouped there is material for scores of exceptions to any rule that can be promulgated. It is inadvisable even to generalize as to the date of the annual pruning, for in our unstable climate this will vary according to the season; moreover what is meet and fit for roses in Cornish or south coast gardens, for instance, may well be weeks too early for the same roses on the cold clays of the Midlands or in the chilly valleys of the Cotswolds. All that can be said with tolerable certainty is that the hybrid perpetuals and hybrid teas, which between them constitute the mass of garden roses of to-day, should be taken in hand annually as soon as all reasonable chance of hard frost has gone, the dwarf teas and noisettes coming under the knife about a fortnight later.

It is a safe axiom that pruning is better done late than early, as those will have good reason to know who, against their better judgment, were this year tricked into trying the edge of their pruning knife on roses that had themselves been fooled into donning their March dress before last month (February) was half out of the way.

It will, perhaps, assist unthinking folk to appreciate the main object of using the pruning knife at all if they realize that the active life cycle of the garden roses is one continual throwing out of fresh growths, and that if these are allowed to accumulate the plant eventually becomes a veritable

thicket of shoots and stems, young and old. The whole energy of the plant is needed to supply this mass of wood with sap, and consequently there is little, if any, to spare for the production of bloom. If the pruner intervenes and cuts out the old wood, the excessive drain on the plant is stanched and its life-blood diverted to the young growth and the development of the flowers.

THE IMPORTANCE OF LIGHT.

In the course of time the young shoots reach maturity, play their part, and have themselves to suffer the knife. The process goes on till at length the plant is exhausted and, as with every living thing, death supervenes.

While the main tenet of pruning these garden roses is that old wood must give place to new, it is not the alpha and omega of the art, for there is beauty in the foliage and growth of rose plants as well as in their bloom; due regard, therefore, should be paid to the natural habit of the plant, so that it may not be pruned out of recognition. With the rose, as with the apple too, light and air are all-important, and the careful pruner will let as much sun into the heart of his plants as he can.

Besides the perpetuals and teas, there are roses galore, and the China and Rugosa, Ayrshire, moss, and Province, as well as the Wichuriana and the new hybrid briars, find a place in many gardens. All these have a way of growth of their own, and need handling accordingly. In his dealings with them the inexperienced amateur will find himself faced by many a prickly problem. If he will invest a modest half-crown in the little hand book issued by the National Rose Society many of his difficulties will disappear, but not all, for no book that has ever been written on the subject will avail a man unless he applies to the printed maxims some leavening of his own gumption.—THE TIMES.

EXTRACTION OF POTASH FROM OLIVE OIL.

A. AITA.

In an analysis carried out by SESTINI, the olive oil residuum (a blackish turbid liquid deposited at the bottom of the sink under oil presses) had the following composition:—

	Per cent.		Per cent.
Soluble in water ...	13·57	Magnesium ...	0·12
Alkaline chlorides ...	1·57	Carbon dioxide ...	1·87
Oxide of iron ...	1·34	Insoluble in water ...	1·05
Calcium ...	0·56		

The amount of potash contained in this liquid is about 1·5 per cent. or slightly more. By the evaporation and combustion of 100 gallons of this residuum, from 30 to 35 lb. of ash are obtained. The volume of this liquid is double that of the olive oil produced; estimating the average yearly production of olive oil in Italy at 44 million gallons, it may be calculated that 15,000 tons of ash can be obtained from the liquid residuum of the olive oil made in the country and that the value of this ash exceeds £80,000.

A Commission has recently been appointed to consider the possibility of utilising this residuum for the extraction of potash salts. The Commission informed the ASSOCIAZIONE CHIMICA INDUSTRIALE of Turin that the process is most simple and that the expenses of concentration in an ordinary triple-action apparatus would not exceed 5*d*. per 100 gallons, taking fuel at 33*s*. per ton.

The nitrogen contained in olive oil is about one-third of its potash content and consequently of equal or greater value. It would therefore be advisable to secure both the nitrogen and the potash and reject the incineration method.

PROF. GARELLI has tried the application of LE VASSEUX's process to this residuum. The process consists in the concentration of the liquid in the presence of sulphuric acid until the greater part of the potash has crystallised out as sulphate; the separation of the sulphate of potash, the absorption of the mother-liquor by porous substances in such a manner as to form a complex fertiliser containing organic nitrogen and potash salts. PROF. GARELLI, however, never succeeded in making the sulphate of potash crystallise out; thus he considers that this process cannot be applied.

The Effront process (suggested for the utilisation of fermented molasses and based on fractional distillation) presents technical difficulties and its installation is very expensive. The writer is of opinion that the process suggested by STOLZENBERG for molasses is the most suitable; this consists in concentrating the residuum to the consistency of syrup, and mixing with it a certain quantity of superphosphate; after warming for a short time the mixture turns into a compact mass easily broken, which can remain a long time exposed to the air without undergoing any alteration.—BULL. INT. INST. OF AGRIC.

MANURING FOR POTATOES.

Potato crops, more than any other, may unquestionably be profitably increased by the use of artificial fertilisers, but, as the crop is dependent quite as much upon the season as upon the fertiliser, it may happen frequently that manuring does not appear to give much better results.

Again, manuring will only be of use if combined with effective cultivation.

The effect of artificial fertilisers may become considerably increased by the addition of farmyard manure, which by itself is one of the best manures for potatoes when applied early as the land is being got ready. As the heavy amounts (10 to 20 tons per acre) of farmyard manure, which would be necessary if used by itself, for a complete dressing, are not always available, smaller quantities of 3 to 6 tons per acre may be used profitably in addition to artificial fertilisers.

As a rule, complete manures give by far and away the best results, and may even be used in small dressings in comparatively rich soil, and will then prevent their rapid exhaustion.

The dominant manure for potatoes is potash, and it appears that potassium chloride gives better results in some cases than the potassium sulphate. As our soils are generally rather high in chlorides, the use of potassium sulphate is to be preferred, and it may be used in quantities from 1 to 2 cwt. per acre, according to the quality of the soil and the presence of available potash.

Nitrogen.—Nitrogen is only required in moderate quantities, and gives the best results if applied in the form of nitrate of lime, cyanamide or nitrolin, or of dried blood, which may be used in quantities from 1 to 2 cwt. per acre. This element has at times a somewhat forcing effect on plants, and under some circumstances may act in a detrimental manner. For instance, should the spring crop receive a check from dry weather just as the tubers are setting and this be followed by thunderstorms and heat, there is an over-luxuriant growth of tops, and the energies of the plant are misdirected, with a consequent reduction in yield.

Phosphoric Acid is generally applied, in the form of superphosphate or bonedust, in quantities of from 2 to 4 cwt. per acre.

When a complete mixed fertiliser is to be used, such a one should be chosen which contains from 8 to 12 per cent. of phosphoric acid, 3 to 4 per cent. of nitrogen, and 8 to 9 per cent. of potash, and in quantities of not less than 6 cwt. per acre on soils considered to warrant the application of such dressings. Local conditions vary very much, and are of greatest importance, and even have such an influence on the composition of the soil that an ordinary agricultural analysis may not always be a safe guide; for this reason, small experimental plots are recommended, where the quantity and kind of fertilisers may be gauged to suit the class of soil and other controlling influences These may be designed as follows :—

1. Unmanured.
2. Nitrogen and potash.
3. Potash and phosphate.
4. Unmanured.
5. Nitrogen, potash, and phosphate.
6. Nitrogen, potash, phosphate, and stable manure.

The Application of Artificial Fertilisers.—A concentrated fertiliser is more readily distributed by mixing it with several times its own bulk of sifted soil. If applied directly to the furrows, the root system of the plants is confined to a more limited space, and the crop will suffer to a greater extent in dry weather than if the fertiliser was spread over the land and ploughed or worked in just previous to planting. This is to be commended when the more slowly assimilible fertilisers are used; for others, exclusive of the most soluble kinds, broadcast the fertilisers over the open furrows before planting. The covering in of the crop will tend to incorporate it with the soil. The soluble fertilisers supplying the nitrogen are usually distributed between the rows by hand when the plants are several inches in height, and this is followed up by scuffling the crop.

Farmyard Manure.—Apart from the manurial constituents contained, it acts as a mechanical improver of the soil, providing humus to surround the soil particles, and preventing plasticity; this, as already noted, is of extreme importance in connection with potato-raising. Usually this class of manure will contain from $\frac{1}{2}$ to $1\frac{1}{2}$ per cent. of useful plant food (N.K.P.), but many things have influence on its value; for instance, its origin, the manner and length of time it has been stored, the nature and quantity of food and litter supplied, and the ages of the animals, &c.

If stored and rotted down in pit or heap, it is reduced to a pasty mass, and much valuable material is lost by fermentation and by its depreciation as a mechanical improver of the soil.

In temperate climates it is customary to apply in drills and plant the potatoes on the manure with satisfactory results; but in this climate it is best carted direct from the sheds to the paddock to be manured, and ploughed in some time before planting. This allows for a more complete decomposition.

Green Manure.—To maintain that loose friable state of the soil so necessary in the production of potatoes, and to improve the mechanical condition of lighter soils deficient in vegetable matter, and of soils which have depreciated in texture from continuous cultivation, the practice of growing and "ploughing in" a leguminous crop as a soil renovator, allowing it to rot down in the season prior to the planting of the potatoes, is commended. Ordinary field and cowpeas are both useful for the purpose—the tormer adapted for growing from autumn to early spring, and the latter from the latter time to early autumn. Another useful crop for sowing in autumn is rape.—QUEENSLAND AGRICULTURAL JOURNAL.

A SHORT ACCOUNT OF THE ROYAL BOTANICAL GARDENS AT PERADENIYA IN YATINUWARA, KANDY.

Dear Sir,—The Royal Botanical Gardens at Peradeniya (considered by some as the finest Botanical Garden in the East) is a place with antiquarian associations. At one time Peradeni Nuwara was a Royal residence and known as Chandra-kaantipura. According to history and tradition a large extent of land at Peradeniya was granted by the King to Peradeniya Dissawa, a nobleman of much consequence, for his distinguished services rendered in a war with the Dutch. The Dissawa subsequently plotted (cause not known) against the King. The Dissawa's sister on learning of the treasonable designs of the Dissawa appeared before the King and informed His Majesty of it. Enquiry was made and the Dissawa was found guilty and condemned to be beheaded. His lands were confiscated to the Crown, and was given as a reward to the informant (the Dissawa's sister). On her death she bequeathed this property to Uda Male-deyyo, Queen of King Wijeya Raja Sinha.

Subsequently, King Kirthi Sri (A.D. 1747-80) selected the site for an orchard, and had it planted with different kinds of fruit trees, flowering shrubs and Arabian coffee for the sake of its flowers. It is believed that one of the chief amusements of the poet King Rajadhi was to go on pleasure trips to the Peradeniya Gardens with the favourites of his harem and had the 81 prescribed Royal dishes prepared by them; and to partake of the meals, after a bath in the river, in a richly adorned pavilion, which stood in the middle of the enchanting garden. During these visits no one was allowed to approach within a mile of the Royal Garden. The day was spent in getting the beautiful maidens to recite love songs, such as the following, accompanied with the "veesa" (harprichord):—

Saweni sandha se samagiwa wesa mana nandha,
Aweni sithak nowa samahan sepa vindha;
Lameni kula Narendara Sinha Naranindha,
Maweni liyak Madahuta eriye mandha?

With reference to the third line in the above stanza, the Sinhalese Kings of Ceylon claimed descent from the great Lamini race of the Kings of India, presumably from "Sullvahana," King of Southern India, who ascended the throne in A.D. 78, according to the "Historian's History of the World."

It may be stated that the English Government acquired a portion of land for the Royal Botanic Gardens from Miwature Vidahne, a descendant of Vimal Etana (A.D. 1695), great-grand-daughter of the above-mentioned Peradeniya Dissawa.

It is rather a curious coincidence that the orchard of a Sinhalese Sovereign who had devoted much time and attention in planting it, should have been selected by the British Government in the premier Crown Colony as a Royal Botanical Garden of a great English Queen and Empress.

F. E. GOONERATNE,
Mohotty Mudaliyar of the Galle Atapattu.

"Guardiye Walauwa, Galle, June 11th.

—Ceylon Independent.

CHILLIES.

Chillies and capsicums are the most widely cultivated spices in the world. We are told that originally the plants were natives of South and

Central America, and various names used in the different sections of the globe seem to prove this assertion. The seeds are easily transported, and have therefore been brought to almost every country for cultivation. The growth is most favourable in the warmer climates, and the crop is always in large demand by natives in the fresh state as a vegetable.

The chillies and capsicums used in the spice trade are the fruits of species of the genus *capsicum*, order *Solanaceæ*. The most important species are as follows:—

1. *Capsicum minimum*.—To which belongs our bird peppers, or chillies —Japan, Mombassa, etc. The plant is a shrub, two or three feet tall, with numerous slender spreading branches. In this species the fruit is erect, whereas in other forms of capsicum the pod is pendulous. The plant occurs frequently in the wild state, the seed being carried about by birds.

2. *Capsicum annum*.—To which our Japan, Bombay and other long capsicums belong. This plant is considerably larger than that of the first mentioned species.

3. *Capsicum grossum*.—The most important form of which is the paprika pod cultivated so largely in Spain and Southern France. To this species also belongs the hot cherry capsicum, which has found many buyers in this country since the higher prices for chillies have prevailed.

The surplus crop of chillies or capsicums, or that not used for domestic consumption in the fresh state, is dried and exported. In this market the uses are varied and each use has its favourite grade. The most popular varieties now available are the Japan and Mombassa chillie, the Bombay and Japan capsicum and the cherry capsicum.

CHARACTERISTICS OF POPULAR VARIETIES.

The Japan chillie is a bright red fruit about three quarters of an inch long. There is a Japan chillie imported which averages about one and one-quarter inches long, but the smaller size is usually preferred. This article is the favourite in the pickling trade, and is also used in the grind to lend a bright colour to a cayenne pepper. It does not possess as much strength as some other grades of chillies, and is not usually ground alone. The usual original trade package is a pocket of 50 or 100 pounds.

The Mombassa chillie is a fruit about one-half inch in length, of a brownish-red colour, and is considered the strongest grinding chillie on the market to-day. The original package is also either a 50 or a 100-pound bag.

The Bombay capsicum is a pod about two or three inches long with a thick skin and a heavy stem. It is usually the cheapest grade available for grinding, and if a lot of bright, red, clean, pods are secured will produce a good coloured power of considerable strength. Many importations of this grade have consisted of yellowish or unripe pods, with an excessive proportion of stems and have therefore proven undesirable. The Bombay capsicum is mixed with Mombassa or other strong chillies by many grinders to produce a strong ground red pepper at a moderate price. Most shipments of the article arrive in bales of about 240 pounds each.

Japan capsicums are similar to the Bombays in size, but have a less heavy skin and usually a lesser proportion of stem. They do not make a strong grind, and are used chiefly in mixture with stronger grades to produce a ground red pepper.

The Bombay cherry is a blunt, cylindrical fruit about three-quarters of an inch in length, bright red colour and free from stem. It possesses a fair strength and makes a good coloured, desirable grind. The usual package is a bale of about 240 pounds.—TEA AND COFFEE TRADE JOURNAL.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.)

	QUALITY.	Quotations.
ALOES, Soccotrine cwt.	Fair to fine	100/ a 110/
Zanzibar & Hepatic ,,	Common to good	40/ a 75/
ARROWROOT (Natal) lb.	Fair to fine	3½d a 4d
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair	£7 5/ a £7 10/
East Indian, bleached ,,	Fair to good	£8 12/6 a £8 15/
,, unbleached ,,	Dark to good genuine	£6 a £6 10/
Madagascar ,,	Dark to good palish	£6 15/ a £7 10/
CAMPHOR, Japan lb.	Refined	1/7½ a 1/10½
China cwt.	Fair average quality	155/ nom.
CARDAMOMS, Tuticorin	Good to fine bold	3/6 a 4/6
per lb.	Middling lean	2/ a 2/9
Malabar, Tellicherry ,,	Good to fine bold	3/6 a 4/6
Calicut ,,	Brownish	2/ a 3/
Mangalore ,,	Med Brown to good bold	3/ a 5/10
Ceylon, Mysore ,,	Small fair to fine plump	1/8 a 5/6
Malabar ,,	Fair to good	1/7 a 1/8
Seeds, E. I & Ceylon ,,	Fair to good	1/7 a 1/9
Ceylon "Long Wild" ,,	Shelly to good	1/ a 1/6 nom.
CASTOR OIL, Calcutta ,,	Good 2nds	3½d
CHILLIES, Zanzibar cwt.	Dull to fine bright	110/ a 120/
Japan ,,	Fair bright small	110/ a 120/
CINCHONA BARK.—lb.	Crown, Renewed	3⅜ d a 7d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1¾d a 4¼d
	Renewed	3d a 5¼d
	Root	1¼d a 4d
CINNAMON, Ceylon 1sts.	Fair to fine quill	1/1 a 1/9
per lb. 2nds.	,, ,,	1 a 1/6
3rds.	,, ,,	11d a 1/4
4ths.	,, ,,	10d a 1/1
Chips,	Fair to fine bold	2¾d a 4d
CLOVES, Penang lb.	Dull to fine bright pkd.	11d a 1/2
Amboyna ,,	Dull to fine	10½d a 11d
Zanzibar ,,	Fair and fine bright	6½d a 7d
Madagascar ,,	Fair	8d
Stems ,,	Fair	1⅛d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Liberian ,,	Fair to bold	,,
COCOA, Ceylon Plant. ,,	Special Marks	87/ a 92/6
	Red to good	80/ a 86/
Native Estate ,,	Ordinary to red	57/ a 87/
Java and Celebes ,,	Small to good red	70/6 a 98/
COLOMBO ROOT ,,	Middling to good	32/6 a 40/
CROTON SEEDS, sifted,,	Dull to fair	42/6 a 47/6
CUBEBS ,, ,,	Ord. stalky to good	160/ a 180/
GINGER, Bengal, rough ,,	Fair	35/
Calicut, Cut A ,,	Medium to fine bold	75/ a 85/
B & C ,,	Small and medium	50/ a 70/
Cochin, Rough ,,	Common to fine bold	40/ a 47/6
	Small and D's	40/
Japan ,,	Unsplit	40/
GUM AMMONIACUM ,,	Ord. Blocky to fair clean	60/s a 85s
ANIMI, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,,	,, ,, little red	£11 a £12
,,	Bean and Pea size ditto	70/ a £11
,,	Fair to good red sorts	£8 10/ a £10 10
,,	Med. and bold glassy sorts	£5 10/ a £7 5/
Madagascar ,,	Fair to good palish	£4 a £8
	,, ,, red	£4 a £7
ARABIC, E. I. & Aden ,,	Ordinary to good pale	45/ a 55/ nom.
Turkey sorts ,,	... ...	67/6 a 72/6
Ghatti ,,	Sorts to fine pale	17/ a 27/
Kurrachee ,,	Reddish to good pale	22/6 a 32/6 nom.
Madras ,,	Dark to fine pale	20/ a 30/ nom
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£15 a £20
	com. stony to good block	£4 a £10
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	60/ a 70/
Somali ,,	,, ,,	50s a 60s
OLIBANUM, drop ,,	Good to fine white	50s a 55s
,,	Middling to fair	40s a 45s
pickings ,,	Low to good pale	20 a 35/
siftings ,,	Slightly foul to fine	25s a 35s
INDIA RUBBER lb. Ceylon, Straits, ,,	Fine Para smoked sheets	2/6
Malay Straits, etc. ,,	Crepe ordinary to fine	2/6½
	Scrap fair to fine	2/2
Assam ,,	Fair 11 to ord. red No. 1.	1 10
Rangoon ,,	,, ,, ,,	1/11

	QUALITY.	Quotations.
INDIA RUBBER lb.		
Borneo ,,	Common to good	1/11
Java ,,	Good to fine red	2/
Penang ,,	Low white to prime red	1/9 a 1/10
Mozambique ,,	Fair to fine red ball	2/4
,,	Sausage, fair to good	2 4
Nyassaland ,,	Fair to fine ball	2/3
Madagascar ,,	Fr. to fine pinky & white	1/10
,,	Majunga & blk coated	1/7
,,	Niggers, low to good	1/ a 1/5
New Guinea ,,	Ordinary to fine ball	2/ a 2/3
INDIGO, E.I. Bengal ,,	Shipping mid to gd. violet	14/6 a 15/6
,,	Consuming mid. to gd.	13/9 a 14/6
	Ordinary to middling	12/6 a 13/6
,,	Mid. to good Kurpah	8/9 a 11/
,,	Low to ordinary	6/6 a 8/6
,,	Mid. to fine Madras	4/6 a 5/6
MACE, Bombay & Penang	Pale reddish to fine	2/2
per lb.	Ordinary to fair	2/ a 2/1
Java	,, ,, good pale	2/ a 2/2
Bombay	Wild	5d
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57's	1/9 a 2/
	80's	1/5
	110's	1/
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20
NUX VOMICA, Cochin	Ordinary to good	25/ a 27/
per cwt. Bengal	,, ,,	23/ a 24/
Madras	,, ,,	23/ a 25/
OIL OF ANISEED lb.	Fair merchantable	3/5½
CASSIA ,,	According to analysis	4/ a 4/3
LEMONGRASS oz.	Good flavour & colour	1¾d
NUTMEG ,,	Dingy to white	1½d a 1⅜d
CINNAMON ,,	Ordinary to fair sweet	5½d a 1s 6d
CITRONELLE lb.	Bright & good flavour	2/
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	10/6
Madagascar ,,	Fair	10/6
Zanzibar ,,	Fair	10/6
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	8½d
Ceylon ,, ,,	Fair to fine bold heavy	8½d
Singapore ...	Fair	7½d
Acheen & W. C. Penang	Dull to fine	nom.
(White) Singapore ,,	Fair to fine	9¾d
Siam ,,	Fair	9¾d
Penang ,,	Fair	9¼d
Muntok ,,	Fair	10⅝d
RHUBARB, Shenzi ,,	Ordinary to good	2/3 a 3/6
Canton ,,	Ordinary to good	1/6 a 2/6
High Dried,,	Fair to fine flat	1/3 a 1/4
	Dark to fair round	8d a 8½d
SAGO, PEARL, large--cwt	Fair to fine	24/6 a 25/
medium ...	,, ,,	24/6 a 25/
small ...	,, ,,	22/ a 23/
Flour ...	Good pinky to white	18/ a 19/
SEEDLAC cwt.	Ordinary to gd. soluble	55/ a 90/
SENNA, Tinnevelly lb.	Good to fine bold green	1/ a 1/1
	Fair greenish	9½d a 10½d
	Common specky & small	8¼d a 8¾d
SHELLS, M. o' PEARL—		
Egyptian cwt.	Small to bold	50/ a £5 10/
Bombay ,,	,, ,,	60/ a £5 10/
Mergui ,,	Chicken to bold	£6 10/ a £12
Manilla ,,	,, ,,	£6 10/ a £10
Banda ,,	Sorts	30/
Green Snail,,	Small to large	55/ a 75/
Japan Ear ,,	Trimmed selected small to bold	47/ a £5 15
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	25/ a 26/
per cwt. Madras	Inferior to good	Nominal.
TORTOISESHELL—		
Zanzibar & Bombay lb.	Small to bold	10/ a 25/
	Pickings	5/ a 15/
TURMERIC, Bengal cwt.	Fair	37/6
Madras ,,	Finger fair to fine bold	40/ a 42/6
Do. ,,	Bulbs ,, ,, [bright	23/
Cochin ,,	Finger fair	35/ nom.
	Bulbs ,,	25/
VANILLOES— lb.		
Mauritius ... 1sts.	Gd. crystallized 3½a 8½ in.	7/ a 12/
Madagascar ... 2nds.	Foxy & reddish 3½a ,,	6/6 a 7/6
Seychelles ... 3rds.	Lean and inferior	5/6 a 6
VERMILLION ... lbs.	Fine, pure, bright	2/7
WAX, Japan, squares, cwt.	Good white hard	70/

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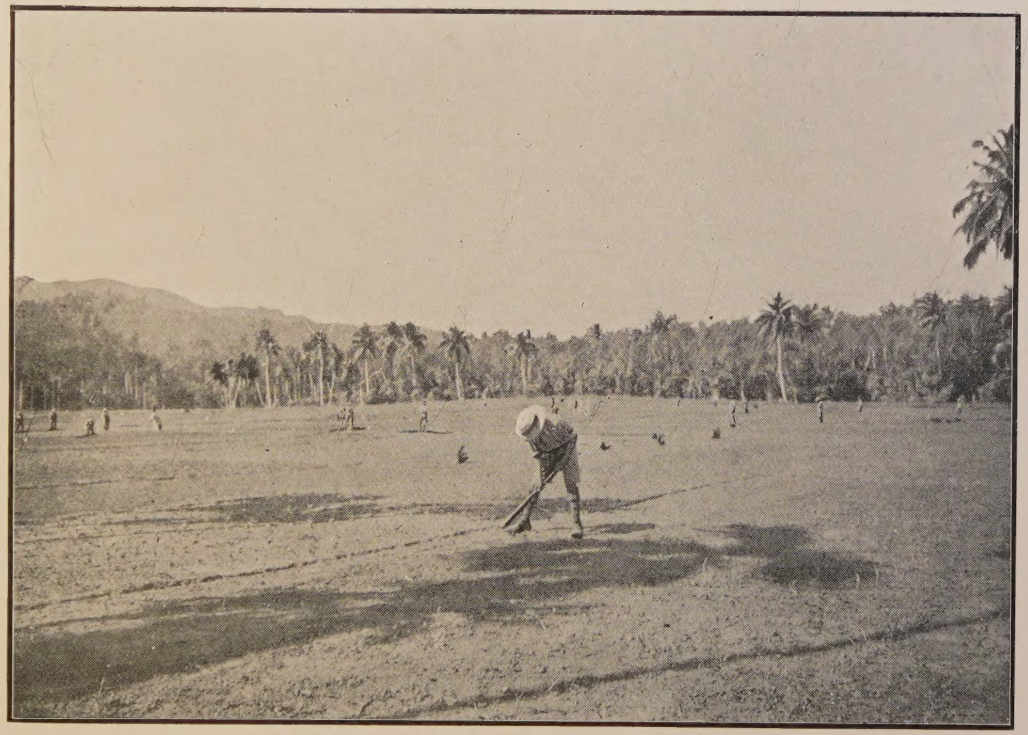

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